

**Perspective Plan for Conservation, Management and
Development of Land Resources for
Central Zone of India**

Sponsored by :

**National Land Use and Conservation Board
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PREFACE

Land is our most precious resource, which is vital for the well being and sustenance of the people. Unfortunately the Indian planners and the people at large have for long neglected the proper care of our land resources, while the relentless increase in our human and livestock population has been putting mounting pressure on our limited resources. The sad consequence of this situation has been that the quality of our land resources has been deteriorating and the overall ecological balance has been threatened.

It is, therefore, imperative that we move in the direction of an integrated approach to the scientific management, conservation and development of our land resources. The National Land Use Policy announced by the Government of India calls for an optimum utilization of our limited land resources keeping in mind the land capability and technology of production as well as the need of ensuring adequate supplies of food, fodder, wood, fuel, raw materials, etc. on a sustained basis without disturbing the ecological balance.

Evolution and implementation of an optimum land use policy requires preparation of detailed perspective plans for different regions of the country. The present study is a modest and initial attempt in this direction, which focusses upon the Central Zone of India comprising the states of Madhya Pradesh and Uttar Pradesh. Sprawling over an area of 7.38 lakh sq. km. across the central parts of the country the Central Zone verily constitutes the

heartland of India, accounting for nearly one-quarter of the country's area and population.

The study looks at the existing land base of the Central Zone including land, forests, livestock and water resources and examines the trends in the land use pattern over time. The projected requirement of foodgrains, fuelwood, fodder, etc. in the year 2001 A.D. have been juxtaposed against the past trends and present productivity levels. Estimates of area under various types of wastelands are presented and a strategy of wasteland development outlined. Finally, an optimum land use pattern for 2000 A.D. is suggested and the institutional requirements of an integrated land use policy are spelled out.

Though the main focus of analysis is at the state level situation, wherever possible we have presented district level analysis also in view of the significant variations in the agro-climatic conditions in different parts of the Zone. The study primarily relies on secondary data from official sources such as the Bulletin of Agricultural Statistics, Census of India, Livestock Census and National Remote Sensing Agency data. Field visits were also carried out to acquaint ourselves with the field level situation in different parts of the Zone.

It is a pleasure for me to put on record the various debts we incurred in the course of the prolonged study. First and above all we are grateful to the National Land Use and Conservation Board, Ministry of Agriculture, Government of India for making a generous grant to enable us to undertake the present study.

received full support from the officials of the Ministry of Agriculture in obtaining required information on various aspects. The two Review Meetings of the Project Coordinators organized by the Ministry at Delhi were very helpful in clearing up various issues related to the study.

We are thankful to the officials of the various departments of the Government of Uttar Pradesh and the Government of Madhya Pradesh, too numerous to be mentioned by name, who provided the required data and help in the conduct of the study and field visits.

Fruitful consultations were held with Shri Dharmendra Kumar, Retired Joint Director, Animal Husbandry, U.P. on matters related to livestock projections and feed requirements.

I must express my appreciation of the dedicated work done by the project staff, who collected and processed enormous data with meticulous care. My colleague and Co-Project Director, Dr.S.S.A. Jafri shouldered his responsibility with enthusiasm. The maps have been prepared under his direction. He also rendered valuable help in analysing data on physiographic aspects, forestry and wasteland development. Dr. K.S. Yadava and Dr.Promod Chandra, Research Fellows in the project, discharged their duties with commendable zeal and supervised the preparation of maps and the collection and processing of data. Computer processing of data was efficiently undertaken by Shri Rajiv Saxena and Shri P.K. Srivastava. Typing of the manuscript has been done with high efficiency and speed by Shri N.B.Bhatt and Shri Manoharan K. Shri

Harish Chandra needs a pat on the back for the arduous task of cyclostyling the report.

Finally, I would like to express my thanks to Prof. S.K. Joshi, Director of our Institute and the Secretarial, Accounts and Library staff of the Institute for providing all the necessary infrastructural support for completing the project.

We would deem it a sufficient reward if our study, with all its limitations and shortcomings, leads to greater awareness and efforts in the direction of the development and conservation of our precious land resources.

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CHAPTER I

The Physical Setting¹

I.1 Location and Area

The Central Zone of India, comprising the states of Uttar Pradesh and Madhya Pradesh, is located between 74°E to 85° longitude and 17°N to 31°N latitude. Sprawling over an area of 7,37,857 sq.km. across the Central parts of the country the Zone verily constitutes the heartland of India, accounting for 22.4 per cent of the country's area. Madhya Pradesh with an area of 4,43,000 sq. km. is the largest state of India, whereas Uttar Pradesh with an area of 2,94,000 sq. km. is the fourth largest, the two states accounting for 13.5 per cent and 8.9 per cent of the country's area respectively.

Uttar Pradesh is bounded by China and Nepal on the north, by Himachal Pradesh, Punjab, Delhi and Rajasthan on the West, by Bihar on the east and Madhya Pradesh on the south. The western boundary of the state is formed by the river Yamuna, eastern boundary by the Ganga and the Ghaghra rivers, while the southern boundary is highly irregular.

Madhya Pradesh is bounded by the states of Orissa and Bihar on the east, Uttar Pradesh and Rajasthan on the north, Gujarat and Maharashtra on the west and Andhra Pradesh on the south.

As per Census of 1981 there were 102 districts and 1,89,480 villages in the Central Zone. Since then a few more districts have been carved out of the existing boundaries for purposes of

1. The description of the various physical features of the Central Zone in the Chapter is based on various Government publications and draws heavily from the book India: A Regional Geography edited by R.L. Singh (National Geographical Society of India, Varanasi, 1971).

administrative convenience. Uttar Pradesh had 57 districts, 659 towns and 1,12,566 villages in 1981 as compared to 45 districts, 303 towns and 76,914 villages in Madhya Praesh. The administrative divisions of the Central Zone have been shown in Map I.2.

Thus, in terms of size Central Zone as well as its two constituent states are really gigantic entities full of variations in physical features and levels of economic development which must be taken into account by any plan, whether concerned with utilization of the natural resources or overall economic development.

I.2 Physiography

The Central Zone can be divided into three distinct and large physiographic regions, namely, the U.P. Himalayas, the great Gangetic Plain and the Southern Plateau.

The U.P. Himalayas, popularly known as the Kumaon Himalayas stretch over a long corridor on the north side of Uttar Pradesh. Of a relatively recent geological formation the U.P. Himalayas present a highly rugged and varied topography, covered by high snow capped mountains, dissected by a number of rivers forming the three major river systems of the Ganga, the Yamuna and the Kali, cradling numerous lakes of varying size, with green valleys and lush forests the U.P. Himalayas present a breathtaking scenery.

The U.P. Himalayas can be divided into three parrallel and well marked physiographic regions, namely, the Greater Himalayas, the Lower Himalayas and the sub-Himalayan or the foothill zone. The Greater Himalayas is about 50 kms. in width with relief ranging from 4,800 m. to 6,000 m. The region has some of the

highest peaks and glaciers from which several sacred rivers of the country originate. To the south of the Greater Himalayas are the 75 Km. wide ranges of the Lower Himalayas. The region contains a series of ridges divided by deep valleys with average relief between 1,500 m. and 2,700 m. at the ridges and 500 to 1,200 m. in the valleys. The region contains a number of beautiful lakes and hill stations. The sub-Himalayan or the Siwalik region is formed by the long chain of narrow and low hills, stretching in north-west and south-east direction all along the Lower Himalayas. The relief is relatively even averaging between 750-1200 m. with well forested slopes, the Siwaliks descend gently into flat valleys called duns.

The vast Gangetic Plain, lying between the Himalayas on the north and southern plateau on the south, covers about two thirds of the state of Uttar Pradesh. The whole region is criss-crossed by the river Ganga and its various tributaries. The Gangetic Plain mostly comprises highly fertile alluvium tract of pleistocene and recent deposits of clay and sand. With an average relief between 80 m. and 250 m. the seemingly endless Gangetic Plain presents a almost featureless topography the monotony of which is broken by numerous ponds, lakes and rivers. The tarai-bhabhar Zone along the northern foothills has a distinct topography. Bhabhar is the narrow belt skirting the Siwaliks, where the rivers suddenly flatten out and deposit the coarser boulders and gravels. Tarai constitutes the marshy tract covered with forests and grasses, a large part of which has been reclaimed for cultivation purposes. Another topographically noteworthy tract is the ravine landscape along the lower reaches of the rivers Yamuna and Chambal.

The Southern plateau comprising Bundelkhand region of southern U.P. and the state of Madhya Pradesh forms part of the peninsular uplands. It presents a variegated topography of hills, plains, valleys and plateaus. The Satpuras and the Vindhyas are the two parallel mountain ranges running west to east through the middle of Madhya Pradesh. The average elevation rises to about 300 m. with occasional summits rising upto 1000 m.

From the point of view of physiography the state of Madhya Pradesh can be divided into several regions. The northern region comprises low lying areas around Gwalior and to the north and north-east of its extending into the Bundelkhand region. The northern plains reveal a homogeneous topography except for the deep ravines along the Chambal river. The Malwa plateau, with its wide table land lie between the Vindhyan barrier and the point just south of Gwalior. Walled in by the Vindhyas on the north and Satpuras on the south stretches the long and narrow Narmada Valley. To the south of the valley lie the Satpura ranges forming a large triangular area. The Satpuras form the watershed between rivers draining into the great Gangetic plains and the other streams flowing towards the south of the west. Towards the east of the Satpuras lie the Chattisgarh plains. To the south of the Chattisgarh plains extends the large virgin and resource rich territory of Bastar Plateau.

The general relief of the Central Zone has been shown in Map I-2.

I.3 Drainage

The drainage system of the Central Zone forms part of both the Himalayan drainage and the Peninsular drainage systems. Uttar Pradesh is served by the well integrated drainage system of

the Ganga flowing into the Bay of Bengal. The entire Gangetic plain is criss-crossed by numerous streams dividing the land into several big and small doabs. Among the major rivers of the region are the Yamuna, Ganga, Ramganga, Kali, Ghaghra, Gomti and Gandak. The streams generally flow in a north-west and south-east direction. The major rivers of the region originate in the Himalayas, though the source of some of them is in bhabhar and tarai in the Himalayan foothills. The drainage of the Gangetic region is dendritic with parallel courses and acute angle functions of tributaries with their master streams. Most of the rivers are perennial streams with well defined courses and gentle gradient. While the upper reaches of the rivers are suitable for generating hydel power, the main stream in the plains provide water for canal irrigation and are also used for navigation purposes. During the monsoons, however, the rivers become swollen flooding large areas particularly in the eastern U.P. causing considerable damage to crops, life and property, at the same time leaving silt and clay, which rejuvenate fertility of the soil.

Madhya Pradesh drainage, which is part of the peninsular drainage system, has two distinct patterns one flowing in the north-west direction towards the Arabian sea and the other in south-eastern direction towards the Bay of Bengal the Satpura ranges marking the dividing line. Some of the peninsular streams like the Chambal, Betwa and Son form part of the Himalayan drainage system. Broad and shallow valleys and low gradients characterise the rivers of the peninsular uplands. Rivers in the Bundelkhand region have a constructed drainage due to presence of dykes and quartz veins. The rivers Narmada,

Mahanadi and Son have a radial drainage system. Parallel patterns are found in the Kaimur hills, while the Vindhyan formations are characterised by the rectangular drainage patterns. The Chambal system represents superimposed drainage pattern.

I.4 Ground Water

The Central Zone is endowed with plentiful ground water resources though its distribution is unequal depending upon the geo-physical conditions. The Gangetic Plains of U.P. are particularly rich in this respect with abundant quantities of rich water resources both free and confined. Ground water is generally available in most parts of the state at a shallow depth of 4-5 metres. The riverain khadar tracts have a lower water table while in the clayey banger region water table is generally higher. In the vicinity of rivers Yamuna and Chambal and in the rocky Bundelkhand area water table is above 12 metres. Permanent water table occurs between 60-90 metres depth. Except the Himalayan region the entire U.P. plain is dotted with innumerable wells.

In the peninsular region of Madhya Pradesh availability of ground water is relatively restricted as well as more varied. In pre Cambrian Zone covering Dandekaraya and Bundelkhand region ground water occurs within 80 metres of the surface in the weathered, jointed and fractured zones of the rocks. It is again patchy in the Cuddapah and Vindhyan Basins. The Gondwana sandstones in Godavari basin have good aquifers, but the Deccan trap covering nearly one-third of the state is a region of poor groundwater availability. However, moderately potential aquifers occur in the quaternary alluvium zone covering the

riverine tract of the Chambal, Narbada and Tapti. Although in comparison to the other parts of peninsular India Madhya Pradesh has the highest usable water potential, due to hard rocks the water tapping is not so easy as in the alluvial tracts of Uttar Pradesh. Only a small part of the ground water potential has been exploited so far.

I.5 Climate

The Central Zone shares the characteristics of tropical monsoon climate though some of its parts belong to the sub-tropical zone also. Variations in temperature, humidity and rainfall are, however, to be observed. The Himalayas are a distinct climatic Zone with its high ice-capped mountains, though here again several micro climatic regions may be distinguished.

The three distinct seasons are the summer season (March to Mid-June), the monsoon season (mid-June to September) and the winter season (October to February). The summer season is the hottest part of the year with temperature often rising to 45° C in May-June. Humidity is low and strong and scorching hot dust-laden winds called 'loo' blow during the day. During the monsoon season, which accounts for 85 to 90 per cent of annual rainfall, there is a sudden fall in temperature and an abrupt rise in humidity. The winter season is characterised by cool weather and clear sky. Chilly conditions develop occasionally and foggy conditions prevail over some tracts particularly in west U.P. minimum temperature drops down to the freezing point in some parts.

As shown in Map I.3 the variations in average annual temperature over most of the parts are not very sharp ranging

between 20°C in the Himalayan region to around 30°C in the plains. In the U.P. Plains average temperature is lower in the northern and north western parts. Similarly in Madhya Pradesh the southern parts and the Bundelkhand region have higher average temperature.

I.6 Rainfall¹

Rainfall characteristics of the Central Zone like average rainfall, number of rainy days, its distribution and variability have been summarised in Table I.1. Nearly 90 per cent of rainfall occurs during the monsoon season lasting from mid-June to mid-September. The monsoon rains are necessary for sowing and for supply of water during the formative poeriod of the kharif crop. Winter rains in the months of January and February help the growth of the rabi crops.

Average rainfall is generally adequate ranging from 50 to 200 Cm. (Map I.4 and Appendix I.1) though there are marked variations within the region. In the U.P. plains rainfall decreases from east to west and from north to south making the south west as the driest part of the state. In Madhya Pradesh also lowest rainfall is observed in the western parts, while maximum rainfall occurs in the eastern districts.

While total precipitation is generally adequate over most parts of the Central Zone, its variability and seasonal patern causes problems for agriculture. As Table I.1 indicates the coefficients of variation in monthly rainfall are very high

1. For a detailed district/tehsil level study of rainfall patterns see Ministry of Agriculture and Irrigation, Government of India, Report of the National Commission on Agriculture, Part IV, Climate and Agriculture, New Delhi, 1976.

Table 1.1 : Rainfall Characteristics of Central Zone

Meteorological Sub-Division	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Ann- ual	Rainy Season (June- Sept.)
<u>A. Normal Rainfall (Cm.)</u>														
Uttar Pradesh (East)	2	2	1	1	1	10	30	30	19	4	1	1	102	89
Uttar Pradesh (West)	2	3	1	1	1	9	29	29	17	3	-	1	96	84
Madhya Pradesh (West)	1	1	1	-	1	13	35	29	18	3	2	1	105	95
Madhya Pradesh (East)	2	3	2	2	2	19	43	39	22	6	2	1	143	123
<u>B. Normals of Rainy Days (NOs.)</u>														
Uttar Pradesh (East)	1	2	0.8	0.6	1	5	13	13	8	2	0.4	0.5	48	39
Uttar Pradesh (West)	2	2	1	0.8	1	4	12	12	7	1	0.3	0.8	44	35
Madhya Pradesh (West)	1	0.9	0.7	0.4	0.8	7	14	13	8	2	0.9	0.6	49	42
Madhya Pradesh (East)	1	2	1	1	1	9	18	17	11	3	0.9	0.5	67	55
<u>C. Coefficient of Variation of Rainfall (%)</u>														
Uttar Pradesh (East)	99	107	140	166	86	59	36	25	43	128	230	146	18	20
Uttar Pradesh (West)	84	89	99	112	75	68	31	33	61	147	203	121	19	22
Madhya Pradesh (West)	114	110	131	151	130	53	29	35	50	114	172	153	18	18
Madhya Pradesh (East)	127	89	120	125	102	47	23	25	34	85	137	169	13	13

Source : Government of India, Report of the National Commission on Agriculture, Part IV, Climate and Agriculture, New Delhi, 1976.

though the variability of annual rainfall is comparatively less. Consequently a number of districts are chronically drought prone areas (see Map I.5). On the other hand, recurrent floods are faced by some districts, particularly in east U.P. plains.

I.7 Soils

Along with climate soils are a major determinant of the cropping pattern and productivity of a region. A variety of soils are found to exist in the Central Zone (see Map I.6 and Appendix I.2). Mountain soils are found on the U.P. Himalayas. These soils are generally shallow and gravelly, brown or dark gray in colour and moderately acidic in nature. The foothills have the tarai soils with medium to coarse alluvium rich in the organic matter. Alluvial soils occur in the vast Gangetic Plains of U.P., covering about two-thirds of the State. The major distinction here is between the alluvial loamy soils of the khadar, the low lying plains subject to innundation and the alluvial clayey soils of the banjar or the higher plains. Patches of usar or reh are also found which are highly alkaline and not fit for cultivation. In the southern region of the state mixed red and black soils are found. The black soils are clayey in texture. Light red soils are found on the midlands and uplands.

The soil types to be found in Madhya Pradesh are alluvium, black, mixed red and black, mixed red and yellow and skeletal. The alluvial soil is found in the Chambhal plains of Morena, Bhind and Gwalior. The black soil is mainly found in the Malwa plateau, Narmada valley and Satpura ridge, covering nearly half of the state. Varying in depth it is usually clayey in texture and develops cracks in the summer season. It is generally sufficient in potash and lime though inadequate in phosphate and

nitrogen. It is particularly suitable for cotton cultivation. Three sub-types of black soils may be distinguished, i.e. deep black soil, medium black soil and shallow black soil. Mixed red and black soil is mainly found in the northern districts of Rewa, Satna, Panna, Tikamgarh and Datia. It is sandy clay responsive to irrigation. Eastern Madhya Pradesh is mainly covered by red and yellow soils, which are generally light and sandy and suitable for rice cultivation. Major part of Bastar is covered by red sandy soil. Skeletal or gravelly soil is found in the rocky areas of Shahdol, Mandala, Sarguja, Raigarh, Bastar and Jhabua district. It is generally of poor quality on which mainly millets and oilseeds are grown.

I.8 Natural Vegetation

Large variations in natural vegetation are found to exist in the Central Zone reflecting the variations in the climate and soils. In U.P. only 17 per cent of the geographical area is under forests, most of which is confined to the hill region, the sub-mountainous tarai belt and the Bundelkhand region. The rest of the state covering the Gangetic Plain, once covered by thick natural forests, has been practically denuded of its forest wealth for purposes of cultivation and settlement. In the hill region a variety of forest cover is found ranging from sub-tropical and temperate type to alpine type. Tropical moist deciduous forests are confined to the tarai area, while in the plains forests are of sub-tropical dry type.

In Madhya Pradesh one-third of the area is covered by forests. The forest cover is much greater in the eastern parts of the state. The southern part is also well covered by forests as compared to the northern parts, where forest coverage is thin. The forests mainly consist of moist or dry deciduous type with

sal, teak and other hard wood varieties. The stunted sub-tropical rain forest occur on the Satpura and Maikal ranges.

Pastures with scrubs and grasses are found in patches in U.P. Himalayas, western margin of U.P., Bundelkhand and sub-humid Madhya Pradesh. The grasses are generally of coarse quality and are subjected to over grazing.

I.9 Agro-Climatic Regions

As we have seen the Central Zone of India is a large region with significant variations in natural features in different parts. While the two states of U.P. and M.P. comprising the Central Zone have a distinct geographical setting, within both the states one may distinguish several natural sub-regions. A number of regionalisation schemes have been developed by different scholars to suit their own analytical objectives. In particular one may refer to the regionalisation schemes developed by the National Atlas Organisation,¹ the Census Commissioner,² Planning Commission,³ National Commission on Agriculture,⁴ P. Sen Gupta⁵ and R.L. Singh.⁶ All these schemes divide the country into several macro, meso and micro regions using district as the

1. National Atlas of India - Physiographic Regions Plate 41.

2. A. Mitra, Levels of Regional Development in India, Census of India 1961, Vol.I, Part I-A(i).

3. Planning Commission, Government of India, Resource Development Regions and Sub-Divisions of India, 1964.

4. Report of the National Commission on Agriculture, Part IV, Climate and Agriculture, Government of India, New Delhi, 1976.

5. P. Sen Gupta, Agricultural Regionalisation of India; in P. Sen Gupta and G. Sdasyuk, Economic Regionalisation of India : Problems and Approaches, Census Commissioner of India, Monograph Series I, No.8, New Delhi, 1968.

6. R.L. Singh, India : A Regional Geography, National Geographical Society of India, Varanasi, 1971.

lowest areal unit. There is broad similarity and considerable overlap among these regionalisation schemes.

More recently the Planning Commission has emphasised the need for agro-climatic zonal planning and has adopted the earlier scheme of resource development regions for this purpose. The scheme takes into account physical features, topography, soils, geological formation, rainfall, cropping pattern, irrigation and mineral resources and classifies the country into 15 resource development regions which are further divided into 64 divisions using district as the lowest areal unit. According to this scheme Central Zone of India is divided into 11 resource development divisions 6 of which fall in U.P. and 5 in M.P. (see Map I.7). For purposes of agro-climatic zonal planning the Planning Commission has slightly modified the scheme by splitting the resource development divisions into sub-zones. Thus according to revised Planning Commission scheme the districts of U.P. fall into 4 agro-climatic zones and 8 sub-zones, while the districts of Madhya Pradesh are divided into 3 zones and 12 sub-zones as indicated in Table I.2. The Planning Commission Agro Climatic Zones and sub-Zones provide a suitable framework for the planning development and management of land resources.

Table 1.2 : Planning Commission Agro-Climatic Zones Falling
in Central Zone

Zone No.	Agro-climatic Zone	Sub-Zone No.	Districts included
<u>Uttar Pradesh</u>			
1	Western Himalayan Region (U.P. Himalayan Division)	3	Chamoli, Dehradun, Garhwal, Tehri, Pithoragarh, Almora, Nainital, Uttar Kashi
4	Middle Gangetic Plains Region (Eastern U.P. Plains Division)	1	Bahraich, Basti, Gonda, Gorakhpur, Deoria
		2	Azamgarh, Ballia, Faizabad, Gazipur, Jaunpur, Varanasi
		3	Mirzapur
5	Upper Gangetic Plains Region (Central U.P. Plains Division)	1	Allahabad, Barabanki, Fatehpur, Hardoi, Kheri, Lucknow, Pilibhit, Rae Bareilly, Sitapur, Sultanpur,
	(North West U.P. Plains Division)	2	Bareilly, Bijnor, Bulandshahr, Gaziabad, Meerut, Moradabad, Muzaffarnagar, Rampur, Saharanpur, Shahjahanpur
	(South West U.P. Plains Division)	3	Agra, Aligarh, Badaun, Etah, Etawah, Farrukhabad, Kanpur, Mainpuri, Mathura
8	Central Plateau and Hill Region (U.P. Bundelkhand Division)	1	Banda, Jalaun, Jhansi, Lalitpur, Hamirpur
<u>Madhya Pradesh</u>			
7	Eastern Plateau and Hill Region (M.P. Eastern Hills and Chattisgarh Division)	1	Balaghat, Bilaspur, Durg, Raipur, Raj Nandgaon
		2	Raigarh, Sarguja, Shahdol
		5	Bastar
8	Central Plateau and Hill Region (M.P. Central Plateau & Hill Division)	2	Chhatarpur, Datia, Tikamgarh,
	(M.P. Windhyan Hills & Plateau Division)	3	Mandla
	(M.P. Northern Plains & Plateau Division)	4	Zabalpur, Panna, Rewa, Satna, Seoni, Sidhi
		5	Bhopal, Damoh, Raisen, Sagar, Sahore, Vidijha
		6	Chhindwara, Betul
		7	Hoshangabad, Narsimhapur,
		8	Bhind, Guna, Gwalior, Shivpuri, Morena
9	Western Plateau and Hill Region (M.P. Malwa Plateau Division)	1	Jhabua
		3	Dewas, Dhar, East Nimar,
		6	Indore, Mandasaur, Rajgarh, Ratlam, Shajapur, Ujjain, West Nimar

Source : Planning Commission, Agro-Climatic Zones : Profiles and Issues, Agro-Climatic Regional Planning Unit, Working Paper No.2, Ahmedabad, 1989.

Appendix I.1(i) : Area, Rainfall and Soil Types in Central
Zone : Uttar Pradesh

District	Area (Sq.Km.)	Annual Rainfall (Cm.)	Soil Types
1. Agra	4805	65.6	Alluvial, Medium Black
2. Aligarh	5019	66.3	Alluvial, Saline
3. Bareilly	4120	110.7	Alluvial
4. Bijnor	4848	108.8	Alluvial
5. Budaun	5168	82.1	Alluvial
6. Bulandshahr	4352	67.4	Alluvial, Saline
7. Etah	4446	69.5	Alluvial, Saline
8. Etawah	4326	75.2	Alluvial, Saline
9. Farrukhabad	4274	79.3	Alluvial
10. Ghaziabad	2590	72.0	Alluvial, Saline
11. Meerut	3911	72.0	Alluvial, Saline
12. Mainpuri	4343	71.4	Alluvial
13. Mathura	3811	59.3	Alluvial, Saline
14. Moradabad	5967	94.4	Alluvial
15. Muzaffarnagar	4176	75.9	Alluvial
16. Pilibhit	3499	124.2	Alluvial
17. Rampur	2367	110.7	Alluvial
18. Saharanpur	5595	94.9	Brown Hills
19. Shahjahanpur	4575	102.0	Alluvial
20. Barabanki	4401	100.2	Alluvial
21. Fatehpur	4152	90.4	Alluvial, Saline
22. Hardoi	5986	87.9	Alluvial
23. Kanpur	6176	80.2	Alluvial, Saline
24. Lakhimpur-Kheri	7680	106.9	Alluvial
25. Lucknow	2528	95.9	Alluvial
26. Rae Bareli	4609	92.8	Alluvial
27. Sitapur	5743	97.4	Alluvial
28. Unnao	4558	83.8	Alluvial, Saline
29. Ailahabad	7261	92.6	Alluvial, Red & Yellow
30. Azamgarh	5740	102.1	Alluvial
31. Bahraich	6877	114.8	Alluvial
32. Ballia	3189	101.3	Alluvial
33. Basti	7228	126.4	Alluvial, Calcerous Alluvial
34. Deoria	5445	114.5	Alluvial, Calcerous Alluvial
35. Faizabad	4511	100.8	Alluvial
36. Ghazipur	3377	105.2	Alluvial
37. Gonda	7352	115.0	Alluvial
38. Gorakhpur	6272	136.4	Calcerous Alluvial
39. Jaunpur	4038	100.0	Alluvial
40. Mirzapur	11310	113.4	Alluvial, Red & Yellow
41. Pratapgarh	3717	97.8	Alluvial
42. Sultanpur	4436	100.0	Alluvial
43. Varanasi	5091	105.6	Alluvial, Red & Yellow
44. Almora	5385	NA	Brown Hills
45. Chamoli	9125	NA	Brown Hills
46. Dehradun	3088	214.2	Brown Hills

47. Nainital	6794	156.6	Alluvial, Brown Hills
48. Pithoragarh	8856	NA	Brown Hills
49. Pauri Garhwal	5440	NA	Brown Hills
50. Tehri Garhwal	4421	NA	Brown Hills
51. Uttar Kashi	8016	NA	Brown Hills
52. Banda	7624	94.6	Alluvial, Mixed Red & Black
53. Hamirpur	7165	85.1	Mixed Red & Black
54. Jalaun	4565	78.3	Mixed Red & Black
55. Jhansi	5024	87.9	Medium Black
56. Lalitpur	5039	87.9	Mixed Red & Black

Source : (i) Statistical Diary of U.P.

(ii) Indian Agriculture in Brief

Appendix I.2(ii) : Area, Rainfall and Soil Types in Central
Zone : Madhya Pradesh

District	Area (Sq.Km.)	Annual Rain- fall (Cm.)	Soil Type
1. Raipur	21253	138.5	Mixed Red & Black, Red & Yellow
2. Durg	8537	127.0	Red Loamy, Red & Yellow
3. Rajnandgaon	11127	127.0	Red Loamy, Red & Yellow
4. Bastar	39114	153.2	Red Loamy, Red and Yellow
5. Bilaspur	19897	139.2	Red and Yellow
6. Sarguja	22337	149.3	Red and Yellow
7. Raigarh	12924	161.9	Red and Yellow
8. Jabalpur	10160	127.4	Deep Black, Medium Black Skeletal
9. Balaghat	9229	162.3	Shallow Black, Red Loamy Red and Yellow
10. Chindwara	11815	132.4	Shallow Black, Skeletal
11. Seoni	8758	138.5	Shallow Black, Red and Yellow, Skeletal
12. Mandla	13269	157.0	Shallow Black, Red and Yellow, Skeletal
13. Narsinghpur	5133	138.1	Deep Black, Skeletal
14. Sagar	10252	123.5	Medium Black
15. Damoh	7306	122.5	Deep Black, Medium Black Mixed Black and Red
16. Panna	7135	117.6	Mixed Red and Black
17. Tikamgarh	5048	100.1	Mixed Red and Black
18. Chhatarpur	8687	107.5	Mixed Red and Black
19. Rewa	6314	123.6	Medium Black, Mixed Red & Black, Red & Yellow
20. Sidhi	10526	124.8	Medium Black, Red & Yellow
21. Satna	7502	110.0	Mixed Red & Black
22. Shahdol	14028	139.7	Medium Black, Mixed Red & Black, Red & Yellow, Skeletal
23. Indore	3898	98.1	Medium Black
24. Dhar	8153	83.3	Medium Black
25. Jhabua	6782	82.8	Medium Black
26. Khargone	13450	83.2	Medium Black
27. Khandwa	10779	88.0	Medium Black
28. Ujjain	6091	89.2	Medium Black
29. Mandsaur	9791	82.5	Medium Black, Mixed Red & Black
30. Ratlam	4861	89.6	Medium Black, Mixed Red & Black
31. Dewas	7020	108.3	Medium Black
32. Shajapur	6196	97.7	Medium Black
33. Morena	11594	72.0	Medium Black
34. Bhind	4459	66.8	Medium Black
35. Gwalior	5214	75.1	Alluvial
36. Shivpuri	10278	81.63	Medium Black, Mixed Red & Black
37. Guna	11065	105.4	Medium Black, Mixed Red & Black

38. Dalia	2038	73.1	Medium Black, Mixed Red & Black
39. Bhopal	2772	124.5	Medium Black
40. Sehore	6578	124.5	Medium Black
41. Raisen	8466	133.1	Deep Black, Medium Black
42. Vidisha	7371	113.4	Medium Black
43. Betul	10043	108.4	Medium Black, Shallow Black, Skeletal
44. Rajgarh	6154	110.1	Medium Black
45. Hoshangabad	10037	129.5	Deep Black Medium Black, Skeletal

Source : (i) Pocket Compendium of Madhya Pradesh Statistics

(ii) Indian Agriculture in Brief

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CHAPTER II

Population and Income Trends

II.1 Population Size and Structure

Uttar Pradesh, with a population of 11.09 crores in 1981, is the most populous state of the country, while Madhya Pradesh, with a population of 5.22 crores, ranks sixth. The degree of urbanisation is quite low in both the states, where around 80 per cent of the population lives in the rural areas (Table II.1). Sex ratio is adverse in both the states as the females constitute 46.9 per cent of total population in U.P. and 48.5 per cent in M.P. About 21 per cent of population belongs to scheduled castes

Table II.1 : Population Characteristics of Central Zone, 1981
(Figures in Lakhs)

Item	Uttar Pradesh	Madhya Pradesh
Total Population	1108.6	521.8
Rural Population	909.6(82.1)	415.9(79.7)
Urban Population	199.0(18.0)	105.9(20.3)
Density of Population) Total	377	118
(Persons/sq./km.)) Rural	313	95
Male Population	588.2(53.1)	268.9(51.5)
Female Population	520.4(46.9)	252.9(48.5)
Scheduled Castes Population	234.5(21.2)	73.6(14.1)
Scheduled Tribes Population	2.3(0.2)	119.9(23.0)
Working Population (Main + Marginal)	340.5(30.7)	224.0(42.9)
Age Distribution		
0 - 14 Years	461.8(41.7)	215.1(41.2)
15 - 59 Years	471.0(51.5)	272.8(52.3)
60+ Years	75.8(6.8)	33.6(6.4)

Source : Census of India, 1981

Note : Figures in parentheses show per cent to total state population.

in U.P., while the ratio is 14 aaper cent in M.P. (Table II.1). There is a large concentration of tribal population in M.P. (23 per cent), though their numbers is negligible in U.P. work participation rates are distinctly higher in M.P. (42.9 per cent) as compared to U.P. (30.7 per cent). The age structure of population is more or less similar in the two states with over 40 per cent of population in the age group below 14 years and around 52 per cent population in the age group 15-59 years (Table II.1).

II.2 Population Density

In terms of population density the two states in the Central Zone present a contraasting picture. U.P. has a higher population density of 377 persons per sq.km. as compared to the density of only 118 persons per sq.km. in the M.P. Density in rural areas in 313 and 95 in U.P. and M.P. respectively. As a result of continuous increase in population net area sown per capita has shrunk to only 0.15 hectare in U.P. and to 0.37 hectare in M.P. Thus, biotic pressure is much heavier in U.P. as compared to M.P.

There are, however, considerable variations in the population pressure at the district level in the Central Zone (Map II.1 and Appendix I.1). In U.P. density is much lower in the hill region and Bundelkhand as compared to the Gangetic plains. Highest density exceeding 600 per sq. Km. is observed in the eastern border of the state. In M.P. density is below 200 per sq.km. in most of the districts. It is relatively lower in the eastern parts of the state as compared to the Western parts. Table II.2 shows the distribution of districts according to the range of density in the Central Zone.

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Table II.2 : Distribution of Districts According to Range of Population Density, 1981 (Nos.)

Density Range (Persons@Sq.Km.)	Uttar Pradesh	Madhya Pradesh
Below 100	3	12
Between 100 & 200	7	27
Between 201 & 300	6	4
Between 301 & 400	9	2
Between 401 & 500	12	-
Between 501 & 600	9	-
Above 601	10	-
All Districts	56	45

Source : Based upon Appendix II.1(i) & (ii).

Similar differences are to be observed in the agrarian density, i.e. per capita net sown area (Appendix II.1 and Map II.2). The severity of biotic pressure in U.P. can be seen by the fact that in as 22 districts per capita net sown area is below 0.15 ha. and in another 26 districts area sown per capita

Table II.3 : Distribution of Districts According to Range of Per Capita Net Area Sown, 1983-86
(Nos.)

Per Capita Net Sown Area (in ha.)	Uttar Pradesh	Madhya Pradesh
Below 0.15	22	1
0.15 - 0.20	26	2
0.21 - 0.25	4	3
0.26 - 0.30	1	6
0.31 - 0.35	2	3
0.36 - 0.40	1	10
0.41 - 0.45	-	13
0.46 and Above	-	7
All Districts	56	45

Source : Based upon Appendix II.1(i) and (ii).

is between 0.15 and 0.20 ha. (Table II.3). On the other hand, in Madhya Pradesh agrarian density is much lower as most of the districts fall in categories with more than 0.30 ha. net sown area per capita. It may, however, be added that agriculture in M.P. is mostly rainfed unlike U.P. where irrigation facilities are much better developed.

II.3 Population Trends

The demographic pressure in the Central Zone has been increasing rapidly in the recent decades as can be seen from Table II.4. Thus, between 1951-81 population of U.P. increased by 75.5 per cent and that of M.P. by as much as 100.0 per cent as compared to an increase of nearly 90 per cent in India as a whole. What is more alarming is the fact that the rate of population growth has been accelerating in successive decades. U.P. experienced a relatively lower rate of growth between 1951 and 1971, mainly on account of a very high though declining death rate. However, during the decade 1971-81 the rate of population growth in U.P. (2.30 per cent per annum) slightly exceeded that of M.P. (2.27 per cent per annum) as well as that of India as a

Table II.4 : Growth of Population in Central Zone,
1901-1981

Years	Population (in Million)			Annual Compound Growth Rate		
	U.P.	M.P.	India	U.P.	M.P.	India
1901	48.6	16.9	238.3	-	-	-
1911	48.2	19.4	252.0	-0.08	1.39	0.56
1921	46.7	19.2	251.2	-0.31	-0.10	-0.03
1931	49.8	21.3	278.9	0.64	1.04	1.05
1941	56.5	24.0	318.5	1.27	1.29	1.33
1951	63.2	26.1	361.0	1.13	0.85	1.25
1961	73.8	32.4	439.1	1.56	2.26	1.97
1971	88.3	41.7	547.9	1.81	2.55	2.23
1981	110.9	52.2	685.2	2.30	2.27	2.25

Source : Census of India

whole (2.25 per cent per annum). An idea of the increasing biotic pressure on land can be had from the fact that the current annual net addition of population is 2.55 million and 1.18 million respectively in U.P. and M.P.

II.4 Birth and Death Rates

Trends in birth and death rates as per the sample Registration Scheme since 1971 have been shown in Tables II.5(i) and II.5(ii). The tables reveal a very high level of birth rates in both the states - 37.6 in U.P. and 39.4 in M.P. reflecting the overall backwardness of the region and ineffectiveness of the family welfare programme. By 31 March 1986 the percentage of couples effectively protected due to all methods was reported at 31.9 for M.P. and 20.6 for U.P. against all India achievement of 34.9. Both the birth rate and death rate in the two states are significantly above the national average. Thus, both U.P. and M.P. are in the potential explosion stage of demographic transition, a fact which should cause anxiety to over planners.

Log linear regression on birth and death rates reveal a declining trend at the rate of 1.12 per cent per annum and 2.40 per cent per annum respectively in U.P. and 0.13 per cent and 1.42 per cent respectively in M.P. (Table II.6). In case of M.P. the regression coefficients were however, found to be non-significant. These rates imply a continued rapid population growth in the Central Zone.

II.5 Population Projections

We have worked out the projected population of the two states upto 2000AD at 5 year intervals on the basis of the log linear regression on birth and death rates for the period 1970-1985. The projected shown in Table II.7 the Projections show an

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Table II.5(i) : Trends in Birth Rate and Death Rate in U.P., 1971-1985

Year	Birth Rate			Death Rate		
	Total	Rural	Urban	Total	Rural	Urban
1971	44.9	46.3	34.7	20.1	21.1	13.1
1972	43.2	44.4	34.2	25.6	27.1	14.8
1973	41.7	43.0	32.9	19.4	20.4	12.6
1974	42.1	43.5	32.0	19.7	20.8	12.0
1975	43.1	44.5	33.9	22.6	23.7	14.8
1976	40.0	41.2	32.5	20.5	21.7	12.9
1977	40.3	41.5	32.3	19.1	20.1	11.9
1978	40.4	41.6	32.0	20.2	21.2	13.4
1979	39.6	40.7	32.1	16.2	17.1	10.1
1980	39.4	40.3	33.0	16.6	17.6	10.3
1981	39.6	40.8	31.5	16.3	17.3	9.9
1982	38.6	39.9	32.5	15.1	16.3	9.4
1983	38.4	39.6	32.8	15.7	16.9	10.4
1984	38.7	39.8	34.3	17.8	19.1	12.2
1985	37.6	39.0	31.6	15.8	17.2	9.6

Source : Sample Registration Bulletin, Registrar General of India, New Delhi .

Table II.5(ii) : Trends in Birth Rate and Death Rate in M.P., 1971-1985

Years	Birth Rate			Death Rate		
	Total	Rural	Urban	Total	Rural	India
1971	39.2	40.1	34.5	15.7	16.5	11.0
1972	39.3	40.4	32.9	18.7	19.9	11.6
1973	37.4	38.3	32.8	16.9	17.9	11.2
1974	36.6	37.5	31.8	15.8	16.9	9.6
1975	40.3	41.7	32.6	18.5	19.8	11.1
1976	39.8	41.0	33.2	16.5	17.7	10.2
1977	38.3	39.4	32.5	17.9	19.4	9.6
1978	37.3	38.5	30.3	15.1	16.1	9.9
1979	37.8	39.0	31.5	15.3	16.5	8.7
1980	37.1	38.1	32.0	15.2	16.4	9.3
1981	37.6	38.8	31.4	16.6	18.0	9.3
1982	38.5	39.9	32.4	14.9	16.3	9.0
1983	38.5	40.1	32.0	14.5	15.9	8.7
1984	36.9	38.1	32.2	14.2	15.5	9.0
1985	39.4	41.0	33.0	14.20	15.3	9.4

Source : Sample Registrar Bulletin, Registrar General of India, New Delhi.

Table II.6 : Log Linear Regression on SRS Birth and Death
Rate in U.P. and M.P. : 1970-1985

Variable	Constant Term	Beta	Std. Error of Beta	R-Square	F Value	Annual Rate of Change %
<u>Uttar Pradesh</u>						
<u>Birth Rate</u>						
Total	3.8032	-0.0113	0.0010	0.8952	119.2970	-1.12
Rural	3.8332	-0.0112	0.0011	0.8855	108.3161	-1.12
Urban	3.5243	-0.0036	0.0016	0.2660	5.0771	-0.35
<u>Death Rate</u>						
Total	3.1458	-0.0256	0.0050	0.6561	26.7046	-2.53
Rural	3.1882	-0.0237	0.0050	0.6200	22.8440	-2.34
Urban	2.6763	-0.2434	0.0056	0.5765	19.0580	-2.40
<u>Madhya Pradesh</u>						
<u>Birth Rate</u>						
Total	3.6544	-0.0013	0.0018	0.0369	0.4972	-0.13
Rural	3.6774	-0.0003	0.0020	0.0021	0.0275	-0.89
Urban	3.4961	-0.0025	0.0017	0.1462	2.2239	-0.25
<u>Death Rate</u>						
Total	2.8830	-0.0143	-0.0666	0.4979	12.8977	-1.42
Rural	2.9379	-0.0120	0.0042	0.3893	8.2872	-1.19
Urban	2.4238	-0.0177	0.0033	0.6871	28.5637	-1.76

acceleration in growth rate of population in M.P. and a marginal decline in the same in U.P. Over the period 1981 and 2001 population of U.P. is expected to increase from 110.86 million to 169.56 million and that of M.P. from 52.18 million to 84.64 million. This amounts to an increase by nearly 53 per cent and 62 per cent in the two states respectively implying a growth rate of 2.15 per cent and 2.45 per cent per annum in U.P. and M.P. respectively.

Table II.7 : Projected Birth Rate, Death Rate and Growth Rate of
Population Based on SRS Data Trends, 1981-2001

Year	Birth Rate	Death Rate	Growth Rate (BR-DR)	Projected Population (in million)
<u>Uttar Pradesh</u>				
1981	39.6	16.3	2.33	110.86
1986	37.5	14.6	2.29	123.82
1991	35.4	12.6	2.28	138.64
1996	33.5	10.9	2.26	155.16
2001	32.0	9.7	2.23	169.56
<u>Madhya Pradesh</u>				
1981	37.6	16.6	2.10	52.18
1986	39.3	14.0	2.53	58.79
1991	39.1	13.0	2.61	66.77
1996	38.8	12.1	2.67	76.09
2001	38.6	11.5	2.71	84.64

Note : Projections have been made on the basis of log linear growth rate observed for the period 1971-1985 using Sample Registration Scheme Data.

Against this the medium projections of the Expert Committee, shown in Table II.8, show a lower growth rate - 2.01 per cent and 1.84 per cent per annum in case of U.P. and M.P. respectively for the period 1981-2001. The difference in projected population for 2001 AD in the two estimates amounts to only 2.3 per cent in case of U.P. but is quite wide - 11.3 per cent in case of M.P. The projections of the Expert Committee in case of M.P. seem to err on the lower side in view of the prevailing high birth rates. Particularly the sharp drop in growth rate assumed for the quinquennium 1996-2001 appears to be unreasonable.

Our overall assessment is that the population in the two states of the Central Zone may continue to increase at an annual compound growth rate of around 2.25 per cent during the period 1981-2001, which corresponds to the growth rate observed during

Table II.8 : Projected Population of Central Zone According to Expert Committee, 1981-2001 (Medium Projection)

(in million)

Year	Uttar Pradesh	Madhya Pradesh
1981	110.88	52.18
1986	123.04 (2.10)	58.19 (2.29)
1991	138.47 (2.09)	64.27 (1.92)
1996	150.88 (2.04)	70.20 (1.74)
2001	165.62 (1.92)	75.09 (1.17)
Per cent Change 1981-2001	49.37 (2.01)	43.91 (1.84)

Source : Expert Committee on Population Projection, Census of India, Occasional Paper No.2 of 1987

Note : Figures in parentheses show amount compound Growth Rate during the previous quinquennium.

1971-81. This may be taken as representing high projection, while a growth rate of 2.00 per cent per annum may be taken as representing low projection.

To project urban and rural population we have assumed that the urban-rural growth differential will continue to increase at half of the observed increase during 1961-81. On this basis the proportion of urban population is expected to rise from 17.95 per cent in 1981 to 32.10 Per cent in 2001 in U.P. and from 20.29 per cent to 38.7 per cent in M.P. Thus, if we use the medium projection of the Expert Committee rural and urban population of U.P. would be 11.2 crores and 5.3 crores respectively in 2001. The corresponding figures for M.P. would be 4.6 crores and 2.9 crores respectively. If the projections worked out by us on the basis of trends in SRS birth and death rates are taken into

account the projected rural and urban population would be 11.5 crores and 5.4 crores respectively.

The Expert Committee has projected the districtwise population for 1986 and 1991 on the basis of the share of the district in the increase in population observed during the period 1971-81. The actual formula used is as follows :

$$Pi(86) = Pi(81) + \frac{(P86-P81) \times (Pi(81) - Pi(71))}{(P81 - P71)}$$

where $Pi(71)$, $Pi(81)$ and $Pi(86)$ are the population of the i th district in the years 1971, 1981 and 1986 respectively and $P71$ and $P81$ are the population of the state in 1971 and 1981 respectively and $P86$ is the projected population of the state from the medium projection. Using the same formula and applying it to the medium projection of state population we have projected the districtwise population in U.P. and M.P. for the years 1996 and 2001. Appendix II.2(i) and II.2(ii) give the districtwise projected population in U.P. and M.P. respectively.

II.6 Work Force Structure

According to the Census of 1981 there were 323.98 lakh workers (main) in U.P. and 200.41 lakh workers (main) in M.P. The work participation rate is distinctly higher in M.P. (38.40 per cent) as compared to U.P. (29.22 per cent). Another 1.49 per cent of persons in U.P. and 4.52 per cent in M.P. are classified as marginal workers. In case of male workers (main) the participation rate comes to 50.31 per cent in U.P. and 53.5 per cent in M.P. However, the female work participation rate show a sharp difference between U.P. and M.P. being 5.39 per cent and 22.30 per cent respectively. The higher participation rates in M.P. both for males and females are on account of the larger proportion of tribal population in the state.

Tables II.9(i) and II.9(ii) show the sectoral structure and growth of work force during 1971-81 in U.P. and M.P. respectively. Agriculture continues to be the mainstay of the economy in the two states giving employment to over 75 per cent of the work force. Only about 10 per cent of the work force is engaged in the secondary sector. Tertiary sector is relatively more important in U.P., while livestock and forestry and mining and quarrying are relatively more important in M.P.

The growth of workers during 1971-81 was moderate in U.P. (18.5 per cent) but quite fast in M.P. (31.0 per cent). Primary sector registered a growth of 14.0 per cent in U.P. and 26.6 per cent in M.P. Agricultural labourers, however, show a decline in U.P. The secondary and tertiary sectors have experienced faster growth as compared to the primary sector in both the states. As a result there has been a shift away from the primary sector in employment structure. Though this is an admittedly an encouraging phenomenon by itself, it needs to be added the pace of structural shift has been slow and the dependence on agriculture continues to be very high.

II.7 Trends in State Income

With a per capita income of slightly less than Rs.2000 in 1985-86 against the national average of around Rs.2600, U.P. and M.P. are among the poorest states of the Indian Union. However, being large entities the total state domestic product is quite large. Net SDP amounted to Rs.24,291.5 crores in U.P. and Rs.11,467.9 crores in M.P. in 1985-86. Table II.10 shows the sectoral distribution of income in the two states. Nearly two-fifth of the SDP is contributed by agriculture in both the States. The dependence on the primary sector is relatively greater in M.P., mainly on account of the larger contribution of

Table II.9(i) : Sector-wise Growth of Workers in Uttar Pradesh,
1971-81

Sector	1971		1981		Change 1981 over 1971	
	No. ('000)	Percent	No. ('000)	Percent	No. ('000)	Percent
1. Cultivators	15698	57.4	18958	58.5	3260	20.8
2. Agricultural Labourers	5454	20.0	5177	16.0	-277	-5.1
3. Livestock, Forestry, Fishing, Hunting and Planation etc.	156	0.6	178	0.5	11	6.6
4. Mining and Quarrying	11	0.0	20	0.1	9	81.8
Primary Sector	21330	78.0	24333	75.1	3003	14.0
5. Manufacturing and Repairs						
(a) Household Industry	1002	3.7	1200	3.7	198	19.8
(b) Non-household Industry	990	3.6	1722	5.3	732	73.9
7. Construction	167	0.6	330	1.0	163	97.6
Secondary Sector	2159	7.9	3252	10.0	1093	50.6
8. Trade and Commerce	1111	4.1	1469	4.5	358	32.2
9. Transport Storage and Communication	473	1.7	665	2.0	192	40.6
10. Other Services	2261	8.3	2679	8.4	418	18.5
Tertiary Sector	3845	14.1	4813	14.9	968	25.2
11. Total Main Workers	27334	100.0	32398	100.0	5064	18.5

Source : Census of India, 1971 and 1981

Table II.9(ii) : Sector-wise Growth of Workers in Madhya Pradesh,
1971-81

Sector	1971		1981		Change 1981 over 1971	
	No. ('000)	Percent	No. ('000)	Percent	No. ('000)	Percent
1. Cultivators	8086	52.9	10414	51.9	2328	28.8
2. Agricultural Labourers	4062	26.6	4858	24.2	796	19.6
3. Livestock, Forestry, Fishing, Hunting and Plantation, Orchards	259	1.7	379	1.9	120	46.3
4. Mining and Quarrying	98	0.6	178	0.9	80	81.6
Primary Sector	12505	81.8	15829	78.9	3324	26.6
5. Manufacturing and Repairs						
(a) Household Industry	557	3.0	706	3.5	149	26.8
(b) Non-household Industry	446	3.0	868	4.3	402	82.3
6. Construction	121	0.8	316	1.6	195	161.2
Secondary Sector	1144	6.8	1890	9.4	746	65.2
7. Trade and Commerce	490	3.2	781	3.9	291	59.4
8. Transport, Storage and Communication	206	1.3	336	1.7	130	63.1
9. Other Services	953	6.2	1204	6.0	251	26.3
Tertiary Sector	1649	10.7	2321	11.6	672	40.8
10. Total Main Workers	15296	100.0	20041	100.0	4745	31.0

Source : Census of India, 1971 and 1981

Table II.10 : Sector-wise Net Domestic Product in U.P. and
M.P., 1985-86
(in Rs. Crores)

Sectors	Uttar Pradesh	Madhya Pradesh
1. Agriculture & Allied	10470.2 (43.1)	4792.5 (41.8)
2. Forestry	267.3 (1.1)	306.0 (2.7)
3. Fisheries	64.5 (0.3)	26.6 (0.2)
4. Mining	105.3 (0.4)	635.0 (5.5)
Primary Sector	10907.3 (44.9)	5760.1 (50.2)
5. Manufacturing		
(a) Registered	1639.7 (6.8)	1013.1 (8.8)
(b) Non-registered	1476.6 (6.1)	571.0 (5.0)
6. Construction	1330.2 (5.5)	766.1 (6.7)
7. Electricity, gas and water supply	195.2 (0.8)	258.8 (2.3)
Secondary Sector	4641.7 (19.1)	2609.0 (22.8)
8. Railways	330.0 (1.4)	258.2 (2.3)
9. Transportation & Storage	483.9 (2.0)	318.6 (2.8)
10. Communication	86.8 (0.4)	61.7 (0.5)
11. Trade & Hotels	3787.0 (15.6)	796.5 (6.9)
12. Banking & Insurance	608.6 (2.5)	318.2 (2.8)
13. Real estate, etc.	951.6 (4.0)	200.7 (1.8)
14. Public Admn. & Defence	847.3 (3.5)	434.3 (3.8)
15. Other Services	1647.6 (6.8)	710.6 (6.2)
Tertiary Sector	8742.8 (36.0)	3098.8 (27.0)
16. Net Domestic Product	24291.5 (100.0)	11467.9 (100.0)
17. Per Capita NDP (Rs.)	1991.1	1987.7

Note : Figures in parentheses show per cent share in total NDP.

Source : Central Statistical Organisation, Estimates of State Domestic Product 1970-71.

the forestry and mining sectors. The contribution of the manufacturing sector is also longer in M.P. (22.8 per cent) as compared to U.P. On the other hand, services sector is relatively more developed in U.P. contributing 36.0 per cent of S.D.P. against 27.0 per cent in M.P. mainly on account of the longer contribution of the trade and hotel services in U.P.

Tables II.11(i) and II.11(ii) show the sectorwise net domestic product at constant prices of 1970-71 to 1985-86. Table II.11 shows the parametric growth rate of State Domestic Product by sectors in the two states for the period 1970-85. Net SDP has grown at the rate of 3.90 per cent per annum in U.P. and 3.41 per cent per annum in M.P. The corresponding rates of growth of per capita SDP were 1.56 and 1.18. In general the sectoral growth rates in the two states are comparable to all India growth rates. However, tertiary sector has grown at a relatively slower rate in U.P., while agriculture and allied activities have lagged behind in M.P. while the growth rate of agriculture in U.P. may be regarded as satisfactory, the slow growth of this sector in M.P., which is even less than the population growth of the state, is a matter of concern.

The structure of income has also undergone a marked change over the period 1970-71 and 1985-86. Thus, the share of the primary sector in net SDP at current prices has declined from 60.3 per cent to 44.9 per cent in U.P. and from 62.2 per cent to 50.2 per cent in M.P. On the other hand, the share of secondary sector has gone up from 14.9 per cent to 19.1 per cent in U.P. and from 14.7 per cent to 22.8 per cent in M.P. similarly, the share of tertiary sector shows an increase in the two states - from 24.8 per cent to 36.0 per cent in U.P. and from 23.1 per cent to 27.0 per cent in M.P. As compared to the structural

Table II.11(i) : Sectorwise Net Domestic Product at Constant
Prices of 1970-71; Uttar Pradesh, 1970-86

(In Rs. Crores)

Years	Agric- ulture	Fore- stry	Fish- ery	Min- ing	Primary Sector	Secon- dary Sector	Tertia- ry Sector	Total SDP	Per Capita Income (Rs.)
1970-71	2485.9	64.1	5.4	9.3	2564.8	635.6	1056.1	4256.5	426.3
1971-72	2242.6	66.6	5.6	7.5	2322.3	621.5	1072.8	4016.6	450.0
1972-73	2388.4	70.1	5.8	7.0	2471.3	669.4	1113.0	4253.7	466.9
1973-74	2217.0	63.6	6.0	7.7	2294.2	669.4	1095.1	4058.7	436.2
1974-75	2393.1	60.2	6.2	5.5	2465.0	641.0	1130.6	4236.6	445.6
1975-76	2626.2	58.8	6.9	6.4	2698.2	709.7	1203.2	4611.1	474.3
1976-77	2655.9	53.1	7.0	6.7	2722.6	765.8	1256.7	4745.1	477.0
1977-78	2891.2	55.0	7.2	7.4	2960.8	867.3	1325.8	5153.9	506.1
1978-79	2919.2	55.0	7.4	10.2	2991.8	953.2	1416.2	5361.2	513.9
1979-80	2160.8	54.7	7.9	11.9	2235.3	971.6	1353.3	4560.2	426.4
1980-81	3039.5	51.3	8.2	11.8	3110.8	1064.5	1475.6	5650.9	515.1
1981-82	3106.9	54.5	8.5	12.4	3182.4	1144.5	1544.2	5871.1	521.7
1982-83	3183.9	62.9	10.5	30.3	3287.6	1369.9	1725.2	6382.7	556.0
1983-84	3390.9	61.0	11.0	28.3	3491.2	1453.7	1792.2	6737.1	575.0
1984-85	3422.5	64.2	12.4	24.8	3523.9	1549.6	1865.0	6938.5	580.0
1985-86	3446.3	64.0	16.7	24.7	3551.7	1633.41	1970.2	7155.3	586.5

Source : C.S.O., Estimates of State Domestic Product, 1970-71 - 1985-86,
June 1987.

Table II.11 (ii) : Sectorwise Net Domestic Product at Constant
Prices of 1970-71 : Madhya Pradesh, 1970-86

(in Rs. crores)

Years	Agric- ulture	Fores- try	Fish- ery	Min- ing	Primary Sector	Secon- dary Sector	Tertia- ry Sector	Total SDP	Per Capita SDP (Rs.)
1970-71	1112.2	74.7	1.9	49.1	1237.9	293.3	460.1	1991.3	484.2
1971-72	1183.4	93.9	2.0	51.4	1330.7	310.8	497.4	2138.9	507.2
1972-73	1070.4	80.7	2.1	56.0	1209.2	340.3	500.5	2050.0	474.4
1973-74	1065.5	90.3	2.2	58.3	1216.3	382.7	511.7	2110.7	476.7
1974-75	1074.3	84.0	2.3	67.6	1228.2	351.2	545.5	2124.9	468.6
1975-76	1217.7	76.6	2.3	74.2	1370.8	358.0	585.9	2314.7	458.7
1976-77	979.1	76.4	2.4	73.5	1131.4	425.0	578.5	2134.9	449.5
1977-78	1262.6	63.9	2.5	76.4	1405.4	430.6	630.6	2466.6	507.9
1978-79	1152.5	74.6	2.6	71.0	1300.7	432.9	656.4	2390.0	481.5
1979-80	764.0	84.7	2.9	79.9	931.5	459.4	678.3	2069.2	408.1
1980-81	1230.3	94.1	3.1	86.2	1413.7	498.4	765.9	2678.0	517.6
1981-82	1278.8	98.2	3.2	88.7	1468.9	521.4	813.1	2803.4	530.5
1982-83	1243.3	90.3	3.9	95.8	1433.3	586.8	872.6	2892.7	535.6
1983-84	1545.0	83.5	4.1	114.5	1747.1	580.0	998.9	3326.0	602.3
1984-85	1358.7	64.9	5.8	127.9	1557.3	624.2	1055.7	3237.2	573.5
1985-86	1536.4	80.2	6.4	132.9	1755.9	683.1	1156.2	3595.2	623.1

Source : C.S.D., Estimates of State Domestic Product, 1970-71 -1985-86,
June 1987.

Table II.12 : Parametric Growth Rate of Net State Domestic Product by Sectors in U.P. and M.P. for the Period 1970-71 to 1984-85

(Per cent per Annum)

Sector	Uttar Pradesh	Madhya Pradesh	India
1. Agriculture & Allied	2.73	1.33	2.06
2. Mining	11.61	5.65	5.38
Primary Sector	2.78	1.56	2.14
3. Manufacturing	7.29	6.00	4.60
(a) Registered	5.66	7.28	4.67
(b) Unregistered	8.70	4.22	3.89
4. Construction	4.32	2.42	2.61
5. Electricity, gas and water supply	15.76	9.95	7.77
Secondary Sector	6.77	5.31	4.30
6. Transport, Communication and Trade	4.82	3.28	5.43
7. Finance & Real Estate	6.16	6.43	7.69
8. Community and Personal Services	2.33	9.24	6.66
Tertiary Sector	4.33	5.98	5.89
Net SDP	3.90	3.41	3.89
Per Capita Net SDP	1.56	1.18	1.61

Source : Directorate of Economics and Statistics, Madhya Pradesh, Growth Rates in Net Domestic Product of Certain States and Indian Union, 1986.

shift in SDP in favour of the non-primary sector, the shift in the structural of work force is much slower.

A closer look at the trends in SDP reveals that there has been a definite breakthrough in the growth rates in the two states and since the mid-seventies the economics of these states

are moving on a higher growth path as is indeed the case at the national level. Thus, during the period 1974-75 to 1986-87 the trend rate of growth of SDP was 4.91 per cent and 4.75 per cent per annum (Table II.13).

Table II.13 : Trend Rates of Growth of Total and Per Capita State Domestic Product in U.P. and M.P. since 1970-71

Period	Compound Growth Rate Per cent Per Annum			
	Total SDP		Per Capita SDP	
	=====		=====	
	U.P.	M.P.	U.P.	M.P.
1970-71 to 1984-85	3.90	3.41	1.56	1.18
1970-71 to 1986-87	4.23	3.81	1.90	1.50
1974-75 to 1986-87	4.91	4.75	2.54	2.46

Note : Rates of growth have been computed by fitting log linear regression on the time series data of SDP at constant prices.

II.8 Income Projections

It would be reasonable to assume, on the basis of the trends in the more recent past, that the SDP in the two states will continue to increase at a rate of 5 per cent per annum. Against this, population is expected to grow at a rate of 2.25 per cent per annum. Thus, per capita income is expected to grow at a rate of 2.75 per cent per annum. We have projected the total and per capita SDP on the above assumption for the period 1985-86 to 2000 - 2001 A.D. The projected figures have been shown in Table II.14.

Table II.14 : Projected Net State Domestic Product in U.P. and M.P. 1985-86 to 2000-2001

Year	Total Net S.D.P. (Rs. Crores)		Per Capita S.D.P. (Rs.)	
	U.P.	M.P.	U.P.	M.P.
<u>A. At 1970-71 Prices</u>				
1985-86*	7155	3595	587	623
1990-91	9132	4588	672	714
1995-96	11655	5856	770	817
2000-01	14875	7474	882	936
<u>B. At 1985-86 Prices</u>				
1985-86*	24292	11468	1991	1988
1990-91	31093	14679	2290	2286
1995-86	39799	18789	2633	2629
2000-01	50943	24050	3028	3023

* Actual

As the projections reveal that at 1985-86 prices the SDP of U.P. will reach the figure of Rs.50943 and that of M.P. Rs.24050 by the year 2000-01. The per capita SDP is likely to rise from around Rs.2000 to slightly more than Rs.3000 over the same period in both the states. In other words, there would be an increase of 110 per cent in SDP and 52 per cent in per capita SDP between 1986-2001. We may add that these may be regarded as optimistic or high projections, though not unrealistic in the light of the recent experience.

Appendix II.1(i) : Districtwise Population and Density in
Uttar Pradesh, 1981

District	Total Popula- tion ('000)	Rural Popula- tion ('000)	Rural Popu- lation as % of Total Population	Density Per sq.km. =====	Per Capita Net Area Sown(ha.)	Popula- tion Growth 1971-81 (%)
1	2	3	4	5	6	7
1. Agra	2852	1742	61.1	594	373	0.12
2. Aligarh	2562	1974	76.9	511	408	0.15
3. Bareilly	2265	1614	71.2	550	403	0.15
4. Bijnor	1926	1445	75.0	397	302	0.18
5. Budaun	1964	1646	83.8	380	326	0.20
6. Bulandshahr	2350	1889	80.4	540	448	0.14
7. Etah	1838	1549	84.3	413	353	0.16
8. Etawah	1749	1491	85.2	404	348	0.16
9. Farrukhabad	2003	1687	84.3	469	400	0.14
10. Ghaziabad	1843	1214	65.87	708		0.10
11. Meerut	2790	1921	68.85	712	503	0.11
12. Mainpuri	1724	1532	88.9	397	357	0.16
13. Mathura	1544	1215	78.7	405	324	0.20
14. Moradabad	3151	2300	73.0	528	393	0.15
15. Muzaffarnagar	2288	1793	78.4	548	438	0.15
16. Pilibhit	1006	843	83.7	288	243	0.22
17. Rampur	1177	863	73.3	497	375	0.16
18. Saharanpur	2674	1950	72.9	478	355	0.14
19. Shahjahanpur	1649	1329	80.6	360	293	0.21
20. Barabanki	2013	1836	91.2	457	422	0.14
21. Fatehpur	1573	1431	91.0	379	351	0.19
22. Hardoi	2294	2027	88.4	383	342	0.18
23. Kanpur	3791	2008	53.0	614	343	0.11
24. Lakhimpur- Kheri	1963	1773	90.3	256	232	0.23
25. Lucknow	2017	959	47.5	798	405	0.07
26. Rae Bareli	1888	1748	92.6	410	385	0.14
27. Sitapur	2338	2098	89.7	407	370	0.18
28. Unnao	1826	1610	88.2	401	358	0.15
29. Allahabad	3781	3011	79.3	531	423	0.12
30. Azamgarh	3533	3215	91.0	615	567	0.12
31. Bahraich	2221	2062	92.8	323	301	0.20
32. Ballia	1926	1750	90.9	604	556	0.12
33. Basti	3577	3405	95.2	495	474	0.16
34. Deoria	3487	3256	93.4	640	607	0.12
35. Faizabad	2370	2110	89.0	525	476	0.12
36. Ghazipur	1942	1787	92.1	575	537	0.13
37. Gonda	2838	2632	92.7	386	361	0.17
38. Gorakhpur	3796	3395	89.4	505	546	0.13
39. Jaunpur	2527	2358	93.3	626	590	0.11
40. Mirzapur	2034	1766	86.8	180	158	0.18
41. Pratapgarh	1807	1716	94.9	486	462	0.13
42. Sultanpur	2038	1970	96.7	459	445	0.14

1	2	3	4	5	6	7	8
43. Varanasi	3697	2706	73.2	726	542	0.09	29.6
44. Almora	773	727	94.0	144	136	0.16	19.2
45. Chamoli	364	336	92.1	40	37	0.12	24.5
46. Dehradun	757	384	50.8	245	132	0.07	31.2
47. Nainital	1133	819	72.3	167	122	0.18	43.4
48. Pithoragarh	480	453	94.4	54	51	0.15	15.5
49. Pauri (Garhwal)	624	559	89.6	115	104	0.15	12.9
50. Tehri (Garhwal)	495	473	95.8	112	103	0.14	24.1
51. Uttar Kashi	191	177	93.0	24	22	0.16	28.9
52. Banda	1536	1354	88.1	262	178	0.33	30.0
53. Hamirpur	1194	996	83.4	167	1411	0.43	20.8
54. Jalaun	987	719	80.1	216	176	0.35	21.4
55. Jhansi	1143	715	62.55	226	123	0.27	
56. Lalitpur	577	501	86.82	115	-	0.34	
Uttar Pradesh	110886	90913	82.0	377	313	0.15	25.5

Source : Calculated from Census of India, 1981 and Agricultural Statistics of U.P.

Appendix II.1(ii) : Districtwise Population and Density in Madhya Pradesh
1981

District	Total Popula- tion (^{'000})	Rural Popula- tion (^{'000})	Rural Popu- lation as % of Total Population	Density Per Sq.km. =====	Per Capita Growth N.A.S. (1971-81) (ha.) (Percent)	Population Growth (1971-81) (Percent)	
1. Raipur	3079	2550	82.8	145	121	0.30	17.8
2. Durg	1890	1289	68.2	221	155	0.29	28.7
3. Rajnandgaon	1168	1023	87.6	105	92	0.43	17.6
4. Bastar	1843	1731	93.9	47	44	0.45	21.5
5. Bilaspur	2953	2545	86.2	148	129	0.28	21.0
6. Sarguja	1633	1492	91.4	73	67	0.36	23.2
7. Raigarh	1443	1322	91.6	112	105	0.37	12.9
8. Jabalpur	2199	1208	54.9	216	124	0.21	30.4
9. Balaghat	1148	1046	91.3	124	114	0.24	17.4
10. Chhindwara	1233	972	78.8	104	83	0.40	24.6
11. Seoni	810	747	92.2	92	86	0.47	21.2
12. Mandla	1037	964	92.9	78	73	0.41	18.8
13. Narsinghpur	650	562	86.5	127	111	0.43	25.3
14. Sagar	1323	955	72.2	120	94	0.38	24.6
15. Damoh	721	617	85.6	99	85	0.38	25.9
16. Panna	540	498	92.2	76	70	0.39	25.9
17. Tikamgarh	737	648	87.9	146	130	0.32	29.6
18. Chhatarpur	887	749	84.4	102	89	0.38	24.5
19. Rewa	1208	1050	86.9	191	172	0.29	23.5
20. Sidhi	990	971	98.1	94	92	0.34	27.5
21. Satna	1153	967	83.9	154	132	0.30	26.3
22. Shahdol	1345	1106	82.2	96	81	0.33	30.6
23. Indore	1409	480	34.1	352	128	0.18	37.5
24. Dhar	1037	924	89.1	130	114	0.47	25.5
25. Jhabua	795	729	91.5	117	108	0.43	19.1
26. Khargone	1631	1390	85.2	121	104	0.38	26.9
27. Khandwa	1154	844	73.1	107	79	0.38	31.2
28. Ujjain	1117	698	62.5	183	117	0.41	29.5
29. Mandsaur	1263	1007	79.7	129	104	0.43	31.4
30. Ratlam	783	542	69.2	161	113	0.39	29.9
31. Dewas	795	647	81.4	113	93	0.44	33.8
32. Shahjapur	840	715	85.1	136	116	0.50	23.9
33. Morena	1203	1125	93.3	112	97	0.30	32.3
34. Bhind	974	808	82.9	218	188	0.34	22.7
35. Gwalior	1108	498	44.9	212	102	0.23	29.1
36. Shivpuri	866	755	87.2	84	74	0.42	28.0
37. Guna	1002	860	85.8	91	78	0.60	27.9
38. Datia	312	251	80.4	158	124	0.42	22.2
39. Bhopal	895	213	23.8	323	86	0.17	74.5
40. Sehore	657	570	86.7	100	87	0.55	29.0
41. Raisen	711	640	90.0	84	76	0.58	28.4
42. Vidisha	783	650	83.0	106	88	0.65	19.0
43. Betul	925	783	84.6	92	78	0.43	25.7
44. Rajgarh	801	696	86.9	130	115	0.50	24.4
45. Hushangabad	1004	752	74.9	100	76	0.45	24.6
Madhya Pradesh	52179	41592	79.7	118	95	0.37	25.3

Source : Calculated from Census of India, 1981 and Agricultural Statistics of M.P.

Appendix II.2(i) : Districtwise Projected Population for U.P.

('000)

District	1991	1996	2001
1	2	3	4
1. Agra	3471	3817	4171
2. Aligarh	3101	3404	3713
3. Bareilly	2834	3151	3475
4. Bijnore	2450	2738	3033
5. Budaun	2342	2544	2750
6. Bulandshahr	2889	3192	3501
7. Etah	2185	2373	2564
8. Etawah	2078	2265	2457
9. Farrukhabad	2395	2640	2890
10. Ghaziabad	2414	2731	3055
11. Meerut	3403	3763	4132
12. Mainpuri	2045	2218	2395
13. Mathura	1867	2040	2217
14. Moradabad	3968	4429	4901
15. Muzaffarnagar	2811	3114	3224
16. Pilibhit	1299	1458	1620
17. Rampur	1494	1667	1844
18. Saharanpur	3377	3766	4164
19. Shahjahanpur	2059	2289	2525
20. Barabanki	2397	2628	2864
21. Fatehpur	1907	2094	2286
22. Hardoi	2758	3032	3312
23. Kanpur	4591	5066	5553
24. Lakhimpur-Kheri	2483	2785	3095
25. Lucknow	3466	2725	2990
26. Rae Bareli	2315	2560	2811
27. Sitapur	2852	3140	3435
28. Unnao	2207	2423	2644
29. Allahabad	4774	5322	5882
30. Azamgarh	4327	4774	5231
31. Bahraich	2773	3090	3414
32. Ballia	2351	2582	2818
33. Basti	4254	4629	5013
34. Deoria	4277	4709	5151
35. Faizabad	2901	3189	3484
36. Ghazipur	2415	2674	2940
37. Gonda	3441	3786	4140
38. Gorakhpur	4639	5148	5650
39. Jaunpur	3133	3464	3804
40. Mirzapur	2605	2922	3247
41. Pratapgarh	2232	2477	2727
42. Sultanpur	2498	2757	3023
43. Varanasi	4666	5213	5774
44. Almora	881	953	1027
45. Chamoli	446	489	534
46. Dehradun	972	1087	1205
47. Nainital	1531	1747	1968
48. Pithoragarh	574	617	661

1	2	3	4
49. Pauri Garhwal	734	792	851
50. Tehri Garhwal	611	669	728
51. Uttar Kashi	239	268	298
52. Banda	1934	2164	2400
53. Hamirpur	1428	1558	1690
54. Jalaun	1182	1298	1416
55. Jhansi	1440	1613	1790
56. Lalitpur	737	824	912
Uttar Kashi	136472	150865	165624

Appendix II.2(ii) : Districtwise Projected Population for M.P.
(*000)

District	1991	1996	2001
1. Bastar	2218	2403	2554
2. Betul	1143	1250	1337
3. Bhopal	1265	1447	1510
4. Raisen	892	980	1054
5. Rajgarh	983	1070	1143
6. Sehore	826	908	976
7. Vidisha	926	997	1055
8. Bilaspur	3542	3831	4069
9. Raigarh	1832	1725	1801
10. Surguja	1986	2159	2302
11. Morena	1669	1848	1995
12. Bhind	1181	1282	1366
13. Datia	377	409	436
14. Guna	1253	1376	1477
15. Gwalior	1395	1536	1652
16. Shivpuri	1084	1171	1279
17. Hushangabad	1229	1340	1431
18. Dhar	1304	1426	1526
19. Indore	1851	2068	2246
20. Jhabua	941	1013	1073
21. Khandwa	2028	2224	2384
22. Khargone	1468	1623	1740
23. Balaghat	1343	1439	1513
24. Chhindwara	1513	1650	1764
25. Jabalpur	2788	3078	3316
26. Mandla	1225	1318	1399
27. Narsinghpur	801	875	936
28. Seoni	972	1052	1117
29. Durg	2374	2612	2808
30. Raipur	3614	3877	4093
31. Rajnandgaon	1368	1467	1548
32. Rewa	1471	1601	1708
33. Salna	1429	1564	1676
34. Shahdol	1707	1885	2032
35. Sidhi	1236	1357	1456
36. Chattarpur	1087	1185	1266
37. Dhamn	892	976	1044
38. Panna	667	730	782
39. Sagar	1623	1770	1891
40. Tikamgarh	930	1025	1103
41. Dewas	1026	1140	1233
42. Mandsaur	1610	1780	1920
43. Ratlam	962	1050	1123
44. Shahjapur	1026	1117	1193
45. Ujjain	1409	1533	1671
Madhya Pradesh	64265	70205	73650

CHAPTER III

Demand Projections

III.1 Methodology

In this chapter an attempt has been made to make demand projections for agricultural commodities upto the period 2001 for the Central Zone. These projections are expected to help in devising an optimum land use pattern for the study area and in setting appropriate production targets. The National Commission on Agriculture has also underscored the need for formulating demand projections at the state level.¹ It is not being implied that each region of the country has to plan for food self-sufficiency. Rather, each region should try to attain its maximum growth potential. However, large regions like the Central Zone placed in a favourable environment for agriculture have to contribute to the requirements of the national economy to the maximum extent possible. For that purpose also one has to estimate the likely level of surplus in the region. Moreover, our investigations show that the net trade inflow/outflow in the Central Zone as a percentage of the production of different commodities is very low.

Making of projections of long term demand is rather a hazardous task as various assumptions regarding the behaviour of a number of economic variables have to be made, on which opinions may differ. Moreover, there are always some new factors emerging in the economy, which can not always be foreseen. Subject to

1. Report on the National Commission on Agriculture, Part III, Demand and Supply, Government of India, 1976, p.5.

these limitations our demand projections have to be seen as broad guidelines to indicate the level of the tasks that lie ahead and identify areas where immediate action has to be initiated. As observed by the National Commission on Agriculture ".... the functional role of the projections may be said to have been fulfilled even if the problem areas are identified".¹

We have followed broadly the methodology of demand projections used by the National Commission on Agriculture 1976. Briefly the methodology consists of the following steps : (a) Computation of per capita availability of commodities in the base year; (b) estimation of expenditure elasticities for different commodities; (c) estimating the expected increase in demand by superimposing the income effect on a base level per capita demand; (d) projection of aggregate human demand by multiplying estimated per capita demand by projected population; and (e) estimating total demand by adding estimated demand for non-human consumption to projected demand for human consumption. The details of the steps followed are described in the following paragraphs.

III.2 Base Year Demand and Availability

The base year per capita consumption in physical quantities of different commodities separately for rural and urban areas has been taken from N.S.S. Report for the year 1977-78 for U.P. and M.P. Since the breakup of expenditure on meat, egg and fish as well as tobacco is not available in NSS data separately, we have not been able to work out demand for these terms.

1. Ibid, p.1.

Per capita daily/monthly consumption of different commodities has been converted into annual consumption. Finally, total consumption has been derived by multiplying per capita consumption in rural and urban areas by the estimated population of the two areas respectively. Population figures have been worked out by intrapolating population figures on the basis of growth of population observed between 1971 and 1981.

For purposes of cross checking we have compared the total consumption derived from N.S.S. data with official estimates of production and availability of different items. Per capita availability of different commodities for the year 1977-78 corresponds to the output during the crop year 1976-77 since there is expected to be a time lag between production and consumption of foodgrains. A deduction of 12.5 per cent has been made in gross production of foodgrains to account for seed and feed requirements and wastage. To this figure net imports have been added taking into account the movement of foodgrains across the state boundaries and net changes in government buffer stocks for which information was culled from official records.

Though at the national level the discrepancy in the availability and consumption of foodgrains was found to be rather small, the discrepancy between estimated consumption and availability turns out to be very large for individual commodities as well as total foodgrains in both U.P. and M.P. (Table III.4(i) and III.4(ii)). Thus, total consumption derived from N.S.S. estimates exceeds total availability by 23.5 per cent in U.P. and

Table III.1(i) : Estimated Consumption, Availability and Production of Food Items During 1977-78 : U.P.

(Quantity in '000 li. Tonnes)

Items	Consumption	Availability	Production	Per Cent Difference Between Consumption and Availability	Per Cent Difference Between Consumption and Production
Rice	5502	3700	4291	48.70	28.22
Wheat	11344	7870	8940	44.14	26.89
Jowar	595	423	484	40.66	22.93
Bajra	934	685	790	36.35	18.23
Maize	593	955	1097	-37.91	-45.94
Barley	552	1021	1168	-45.94	-52.74
Small Millets	139	429	490	-67.60	-71.63
Ragi	74	74	187	0.00	-60.43
Total Cereals	19735	15002	17280	31.55	14.21
Pulses	1811	2454	3991	-63.00	-67.62
Total Food-grains	21546	17446	21271	23.50	1.29
Milk and Milk Product	4036	5693	5693	-29.11	-29.11
Edible Oils	458	430	492	6.51	- 5.91
Sugar	663	767	1471	-13.56	-54.93

Table III.1(ii) : Estimated Consumption Availability and Production of Food Items During 1977-78 : M.P.

(Quantity in '000 M. Tonnes)

Items	Consumption	Availability	Production	Per Cent Difference Between Consumption and Availability	Per Cent Difference Between Consumption and Production
Rice	3421	2401	2797	42.48	22.31
Wheat	3154	2164	2308	45.89	36.75
Jowar	178	109	124	63.30	43.55
Bajra	1395	1122	1282	24.33	8.81
Maize	468	646	738	-27.55	-36.59
Barley	130	106	120	22.64	8.33
Small Millets	380	259	291	46.72	30.58
Ragi	9	-	4	-	125.00
Total Cereals	9140	6806	7665	34.29	19.24
Pulses	551	1337	1909	-58.79	-71.14
Total Food-grains	9691	8145	9574	18.98	1.22
Milk and Milk Product	3029	2927	2000	3.48	51.45
Edible Oils	138	136	156	1.47	-11.54
Sugar	248	220	NA	12.73	NA

19.0 per cent in M.P. the discrepancy was found to be larger for individual commodities. It would look that production of superior cereals is generally under-estimated or its consumption overestimated, while reverse is true for inferior cereals and pulses. One is not in a position to pass judgement on the issue as to which set of data suffers from a larger degree of error.

The estimated consumption of total foodgrains is, however, found to be very near the total reported production in both the states. Hence, one can use either set of figures for purposes of projections. It follows that the analysis would be on a less firm ground as far as individual commodities are concerned.

III.3 Expenditure Elasticities

The expenditure elasticities of demand for different commodities based on cross section household expenditure data have been computed separately for rural and urban areas in U.P. and M.P. by fitting alternative functional forms on N.S.S. consumer expenditure data for the year 1977-78. The following commonly used Engel functions were fitted on the data :

<u>Function</u>	<u>Form</u>	<u>Regression</u>	<u>Coefficient</u>
(1) Linear	$Y = A + B X$	B	$(\frac{X}{Y})$
(2) Semi-Log	$Y = A + B \text{ Log } X$	B	$(\frac{1}{Y})$
(3) Double Log	$\text{Log } Y = A + B \text{ Log } X$	B	
(4) Log Inverse	$\text{Log } Y = A + \frac{B}{X}$	-B	$(\frac{1}{X})$

Where Y = Per capita consumption of a particular item
X = Per capita total expenditure
B = Regression coefficient

The statistical accuracy of elasticity coefficients was tested with the help of significance of 'T' values of the regression parameters and the values of R square. After a close scrutiny of economic and statistical considerations of various functions used log inverse form in case of foodgrains and double log form for non-foodgrains were found to be most suited for purposes of projections. The estimated elasticity coefficients used for projections along with their T values have been given in Table III.2.

Log inverse function in which elasticity coefficient declines in proportion to increase in per capita income is regarded as an appropriate form to describe the time path of demand for cereals, whose demand is likely to reach a saturation point.¹ On the other hand double log form, which implies constant elasticity, is more suited for such commodities whose initial consumption level is low but for which perspective demand is likely to remain below saturation levels.² One limitation of our demand projections may, however, be noted, that is, the sum total of expenditure on individual items may not tally with the total expenditure on all items taken together. But for our broad purpose of formulating production policies for the future the present approach may be regarded as suitable.³

1. National Commission on Agriculture 1976, Part III, op.cit., p.30.

2. Ibid., p.30.

3. Ibid., p.8.

Table III.2 : Estimated Expenditure Elasticity Coefficients for U.P. and M.P. by Rural and Urban Areas, 1977-78

Commodity	Selected Functional Forms	Elasticity Coefficient			
		U.P.		M.P.	
		Rural	Urban	Rural	Urban
1	2	3	4	5	6
Rice	Log-inverse	0.82781 (-5.91)	0.79847 (-4.6683)	0.699952 (-7.15649)	0.730671 (-5.48)
Wheat	"	0.75467 (-5.23)	0.88016 (-10.4036)	0.921351 (-7.9254)	0.608195 (-4.47)
Jowar	"	0.25011 (-2.51)	0.27750 (-3.8731)	0.723977 (-6.9947)	0.211649 (-3.72)
Bajra	"	0.51146 (-5.49)	0.17394* (-0.8378)	0.335700 (-3.2256)	0.364747 (-1.82)
Maize	"	0.52184 (-3.58)	0.45781 (-2.3791)	0.623904 (-6.9830)	0.026493* (-0.14)
Barley	"	0.48987 (-6.31)	0.20033* (-1.83211)	0.1610* (-1.1653)	0.178612* (-1.47)
Small Millets	"	0.29205 (-3.38)	0.79083 (-2.51707)	0.29710 (-2.3575)	0.60836 (-2.89)
Ragi	"	0.93711 (-3.16)	-	0.247846 (-1.3573)	-
Total Cereals	"	0.75018 (-5.78)	0.95185 (-6.03661)	0.740395 (-9.0574)	0.63909 (-5.63)
Grams	"	0.69454 (-4.44)	0.85277 (-4.28428)	0.49670 (-5.3905)	0.733083 (-3.70)
Cereals Subs.	"	0.47332 (-3.65)	0.25560 (-3.3253)	0.086218 (-0.7324)	0.686269 (-3.82)
Pulses	"	0.70588 (-4.69)	0.92002 (-8.55526)	0.877415 (-8.6288)	0.745255 (-5.65)
Total Foodgrains	"	0.90727 (-7.30)	0.97528 (-6.14630)	0.751947 (-9.3213)	0.651737 (-5.59)
Milk & Milk Products	Double Log	1.447069 (26.80)	1.156636 (12.1751)	1.337930 (16.9358)	1.058899 (26.77)
Edible Oils	"	0.961419 (64.09)	0.98297 (15.4360)	1.034883 (26.5355)	0.950028 (33.88)

1	2	3	4	5	6
Meat, Egg and Fish	Double Log	1.304252 (31.81)	1.027065 (15.3293)	0.962462 (12.6640)	1.063210 (31.42)
Vegetables	"	0.915373 (30.52)	0.908334 (19.7464)	0.90082 (27.2976)	0.92729 (33.75)
Fruits and Nuts	"	1.437229 (7.19)	1.433358 (7.5440)	1.464118 (6.1008)	1.357875 (12.77)
Sugar	"	1.004045 (83.67)	0.918128 (16.1075)	1.175711 (23.5142)	0.916783 (37.32)
Salt	"	0.783965 (15.08)	0.804175 (12.7647)	0.591783 (6.6492)	0.578792 (10.44)
Spices	"	0.914367 (30.48)	0.825198 (13.9864)	0.832132 (10.40165)	0.853657 (23.82)
Beverages and Refs	"	1.233978 (25.71)	1.058730 (9.6248)	0.969669 (5.7039)	1.102282 (37.99)
Food Total	"	1.002053 (37.11)	0.999915 (19.5258)	0.977933 (18.1099)	0.927610 (30.64)
Pan, Tobacco etc.	"	0.885761 (34.07)	0.978421 (20.8175)	0.836311 (17.0676)	0.818853 (9.19)
Fuel and Light	"	0.871837 (39.63)	0.971401 (15.2019)	0.708469 (11.6142)	0.870573 (27.85)
Clothing	"	1.258229 (20.63)	1.328194 (12.0745)	1.297162 (14.9099)	1.694250 (20.08)
Footwear	"	1.348039 (7.49)	1.365527 (6.8276)	-	1.66588 (13.69)
Misc. Goods	"	0.980784 (7.99)	0.94505 (15.5949)	1.108663 (16.0676)	-
Durable Goods	"	1.321131 (6.85)	1.244955 (8.8925)	0.208839 (1.7692)	1.477036 (18.21)
Non-Food Total	"	1.004251 (24.49)	1.005392 (25.1348)	1.023432 (14.6205)	1.213414 (9.33)

Note : 1. Figures in brackets denote 'T' values.

2. Figures marked with '*' are not significant at 5 per cent level. Rest of the figures are significant at 5 per cent.

3. Elasticities have been calculated using the N.S.S. Consumption Expenditure Data for Thirty Second Round, 1977-78.

Given the high incidence of poverty and undernutrition in the Central Zone it is not surprising to find high elasticity coefficients for most of the food products. Expenditure elasticity for food products as a whole is nearly 1, while that for foodgrains as a whole is only slightly less than 1 in U.P. and 0.75 in rural M.P. and 0.65 in urban M.P. It is also to be noted that elasticity coefficients are fairly high for wheat and rice, but quite low for inferior cereals. Similarly we find high expenditure elasticities (around 1 or above) in case of non-foodgrain items such as milk, edible oils, meat, vegetables, fruits, sugar, etc. Thus, one would expect a fairly high rate of increase in the demand for food products in the coming years as well as a shift in favour of superior food products.

III.4 Projected Per Capita Demand

Next step in our demand projections is to estimate per capita demand in 2001 by superimposing income effect on the base level demand using the following equation :

$$Y_t = Y_o \left(1 + e \frac{I_t - I_o}{I_o} \right)$$

Where,

- Y_t = Per capita demand in 2001 A.D. for a commodity;
- Y_o = Per capita consumption of the commodity in question in the base year, i.e. 1977-78;
- e = Expenditure elasticity coefficient;
- I_o = Per capita expenditure in the base year;
- I_t = Per capita expenditure in the terminal year.

We have assumed that per capita consumption will increase at the rate of 2 per cent and 3 per cent per annum for rural and

urban areas respectively in both the states. This is in line with the assumptions made by the National Commission on Agriculture in their demand projections and our assessment of the expected increase in per capita income discussed in the previous period.

The estimated per capita consumption levels for agricultural commodities in the rural and urban areas of U.P. and M.P. for the base and the terminal years have been shown in Table III.3.

III.5 Projected Aggregate Demand

Aggregate consumption demand for agricultural products in 2001 has been worked out separately for rural and urban areas by multiplying the projected per capita demand for rural and urban areas by projected rural and urban population using the medium projection of the Expert Committee. Total consumption demand has been arrived at by adding projected rural and urban demand. Aggregate demand has been then derived by adding 20 per cent to account for seed, food, wastage and industrial demand. According to the National Commission on Agriculture the requirement for these purposes is likely to go up from current level of 12.5 per cent of gross output to 19 per cent by 2001.¹

Projected aggregate demand for different commodities in U.P. and M.P. has been shown in Table III.4(i) and Table III.4(ii) respectively. Projected demand for foodgrains is likely to be of the order of 662 lakh tonnes in U.P. and 216 lakh tonnes in M.P. This implies an increase of nearly 169 per cent in case of U.P.

1. op.cit., p.21.

Table III.3 : Per Capita Projected Demand in Rural and Urban Areas in U.P. and M.P.

(Kg. Per Year)

Commodity	Uttar Pradesh				Madhya Pradesh			
	Rural		Urban		Rural		Urban	
	1977-78	2000-01	1977-78	2000-01	1977-78	2000-01	1977-78	2000-01
1. Rice	57.9	85.7	31.9	67.1	76.2	107.1	44.9	77.3
2. Wheat	111.1	159.7	113.4	212.2	57.8	88.7	94.7	151.8
3. Jowar	6.7	7.7	1.0	1.2	32.9	46.6	10.7	12.9
4. Bajra	10.5	13.6	1.8	2.2	4.4	5.2	0.6	0.8
5. Maize	6.7	8.7	0.9	1.2	11.6	15.7	1.3	1.4
6. Barley	6.3	8.1	0.2	0.3	3.2	3.5	0.6	0.7
7. Small Millets	1.6	1.9	0.1	0.2	9.5	11.1	0.6	1.0
8. Ragi	0.9	1.3	-	-	0.2	0.3	-	-
9. Total Cereals	201.6	289.3	149.3	290.0	195.7	279.7	153.4	250.6
10. Gram	4.6	6.5	2.7	3.0	2.4	3.1	1.3	2.3
11. Cereal Substitutes	2.0	2.5	0.2	0.3	1.1	1.2	0.1	0.2
12. Pulses	13.9	19.6	10.9	20.9	8.9	13.4	10.0	17.4
13. Total Food-grains	222.1	338.9	162.9	320.2	207.1	297.2	164.7	270.8
14. Milk and Milk Products	78.1	143.7	116.8	250.6	52.2	92.8	104.6	214.4
15. Edible Oils	4.1	6.3	5.4	10.6	2.5	3.9	4.5	8.7
16. Sugar	6.4	10.1	7.4	14.2	4.5	7.6	7.7	14.5

Table III.4(i) : Projected Demand for Agricultural Commodities
in 2001 for U.P.

(Lakh Tonnes)

Commodity	Consumption Demand =====			Total Demand	Per cent Increase Over 1976-77	Annual Growth Rate (%)
	Rural	Urban	Total			
Rice	96.4	30.3	126.7	152.0	141.6	3.75
Wheat	179.6	112.8	292.4	350.9	170.8	4.25
Jowar	8.6	0.7	9.3	13.0	66.7	2.15
Bajra	15.3	1.1	16.4	23.0	90.1	2.71
Maize	9.8	0.7	10.5	14.7	90.9	2.73
Barley	9.1	0.2	9.3	13.0	80.6	2.49
Small Millets	2.1	0.1	2.2	3.1	72.2	2.29
Ragi	1.5	-	1.5	1.8	25.0	0.93
Total Cereals	325.3	154.2	479.5	575.4	155.6	3.99
Gram	7.3	2.6	9.9	11.9	38.0	1.35
Pulses	22.0	11.1	33.1	39.7	52.9	1.79
Foodgrains	381.1	170.2	551.4	661.7	168.7	4.21
Milk	161.6	133.2	294.8	294.8	277.5	5.70
Edible Oils	7.1	5.6	12.7	12.7	176.1	4.32
Sugar	11.3	7.5	18.8	18.8	184.8	4.47

Table III.4(ii) : Projected Demand for Agricultural Commodities
in 2001 for M.P.

(Lakh Tonnes)

Commodity	Consumption Demand =====			Total Demand	Per cent Increase Over 1976-77	Annual Growth Rate (%)
	Rural	Urban	Total			
Rice	49.3	22.5	71.8	86.2	120.5	3.35
Wheat	40.8	44.1	84.9	101.9	183.1	4.43
Jowar	21.5	3.8	25.2	35.3	93.9	2.80
Bajra	2.4	0.2	2.7	3.8	65.2	2.11
Maize	7.2	0.4	7.6	10.6	73.8	2.33
Barley	1.6	0.2	1.8	2.5	56.3	1.88
Small Millets	5.1	0.3	5.4	7.6	55.1	1.84
Ragi	0.1	-	0.1	0.1	-	-
Total Cereals	128.8	72.8	201.6	241.9	131.5	3.56
Gram	1.4	0.7	2.1	2.5	92.3	2.76
Pulses	6.2	5.1	11.3	13.6	72.0	2.29
Foodgrains	136.9	78.6	215.5	258.6	133.6	3.61
Milk	42.7	62.2	104.9	104.9	246.2	5.31
Edible Oils	1.8	2.5	4.3	4.3	207.5	4.79
Sugar	3.5	4.2	7.7	7.7	208.0	4.80

and nearly 134 per cent in M.P. over the base year 1976-77. Particularly high increase is likely to take place in case of wheat and rice. Even sharper increases in demand levels are expected in case of non-foodgrains generally ranging between 150 per cent and 250 per cent or even more.

Table III.4(i) and (ii) also indicate the required annual rate of growth of output of different agricultural commodities over the base year (i.e. 1976-77) to meet the projected level of demand in the year 2001. Thus the required rate of growth of foodgrains output comes to 4.21 per cent per annum and 3.41 per cent per annum in case of U.P. and M.P. respectively. For non-foodgrain commodities the required rate of growth are even faster, generally varying between 4 and 6 per cent per annum.

III.6 Normative Requirements

We have also projected the requirements of agricultural commodities on the basis of the normative dietary requirement as recommended by the Indian Council of Medical Research. The recommended norms and the projected level of demand have been given in Table III.5. The aggregate requirement of foodgrains is likely to be of the order of 291.8 lakh tonnes in U.P. and 132.2 lakh tonnes in M.P. It may be noted that the projected demand for the agricultural commodities on the basis of N.S.S. consumer expenditure data is of a much higher order, generally more than double of the normative requirements. However, even to meet the normative requirement the output of the commodities has to be stepped up substantially - by over 60 per cent in case of foodgrains and over 100 per cent in case of milk.

Table III.5 : Normative Requirements of Agricultural Commodities in U.P. and M.P. in 2001

Commodity	Per Capita Requirement* (Kg. per Year)	Aggregate Requirement (Net) (in lakh tonnes)		Aggregate Requirement as Per cent of Base Year Availability	
		U.P.	M.P.	U.P.	M.P.
1. Cereals	159.1	263.5	119.4	175.7	175.6
2. Pulses	17.1	28.3	12.8	113.2	98.5
3. Foodgrains	176.2	291.8	132.2	167.7	163.2
4. Leafy and Vegetables	23.4	38.7	17.5	NA	NA
5. Other Vegetables	17.9	29.6	13.5	NA	NA
6. Roots and Tubers	16.1	26.7	12.1	83.0**	19.0**
7. Milk	80.3	133.0	60.3	233.3	207.9
8. Fats and Oils	12.4	20.5	9.3	512.5	930.0
9. Sugar/Jaggery	12.4	20.5	9.3	256.3	465.0

* As recommended by the Indian Council of Medical Research.

** Potato only.

We have also worked out the normative requirement for foodgrains at the district level in the year 2001. To estimate the total requirement to account for seed, fuel and wastage we have added 20 per cent to the net requirement. The estimated foodgrain requirements have been shown in Appendix III.1(i) and III.1(ii). Comparing the estimated requirements in 2001 with the average foodgrain production during the triennium 1983-84, 1984-85 and 1985-86 we find that districts in U.P. and in M.P. are food surplus districts. In other districts the foodgrain output

needs to be stepped up to meet the normative requirements - marginally in some districts and substantially in others. These figures are illustrative of the level of efforts in raising foodgrains output at the district level in the coming years.

Appendix III.1(i) : Normative Requirements of Foodgrains
in 2001 : Uttar Pradesh

(*000 metric tonnes)

District	Cereals	Pulses	Food-grain	Total Requirement	Foodgrain Output (Average 1983-86)	Food-grain Requirement As per cent of Output
1	2	3	4	5	6	7
1. Agra	664	71	735	882	560	158
2. Aligarh	591	63	564	785	915	86
3. Bareilly	553	59	612	734	595	123
4. Bijnor	483	52	534	641	420	153
5. Budaun	438	47	485	582	693	84
6. Bulandshahr	557	599	617	740	954	78
7. Etah	408	44	452	542	611	89
8. Etawah	391	42	433	520	566	92
9. Farrukhabad	460	49	509	611	576	106
10. Ghaziabad	486	522	538	646	399	162
11. Meerut	657	706	728	874	558	157
12. Mainpuri	381	41	422	506	592	85
13. Mathura	353	38	391	469	582	124
14. Moradabad	780	84	864	1030	852	122
15. Muzaffarnagar	545	59	603	469	553	85
16. Pilibhit	258	277	285	342	555	62
17. Rampur	293	32	325	390	483	81
18. Saharanpur	662	71	334	401	699	57
19. Shahjahanpur	402	43	445	534	759	70
20. Barabanki	456	49	505	606	570	106
21. Fatehpur	364	39	403	484	522	93
22. Hardoi	527	57	583	700	671	104
23. Kanpur	883	96	978	1174	878	134
24. Lakhimpur-Kheri	492	53	545	654	571	115
25. Lucknow	476	51	527	632	230	275
26. Rae Bareli	447	48	495	594	506	117
27. Sitapur	546	59	605	726	492	148
28. Unnao	421	45	466	559	468	119
29. Allahabad	936	101	1036	1243	854	146
30. Azamgarh	832	89	922	1106	810	137
31. Bahraich	543	58	601	721	587	123
32. Ballia	448	48	496	595	394	151
33. Basti	797	86	883	1060	952	111
34. Deoria	819	88	910	1092	893	122

1	2	3	4	5	6	7
35. Faizabad	554	59	614	737	679	109
36. Ghazipur	468	50	518	621	453	137
37. Gonda	659	71	729	863	844	102
38. Gorakhpur	899	97	994	1193	958	125
39. Jaunpur	605	65	670	804	614	131
40. Mirzapur	516	55	572	686	458	150
41. Pratapgarh	434	47	480	576	420	137
42. Sultanpur	481	52	533	640	571	112
43. Varanasi	919	99	1017	1220	612	199
44. Almora	163	18	181	217	174	125
45. Chamoli	85	9	94	113	69	164
46. Dehradun	192	21	212	254	91	279
47. Nainital	313	34	347	416	591	70
48. Pithoragarh	105	11	116	135	135	100
49. Pauri Garhwal	135	15	150	180	137	131
50. Tehri Garhwal	116	12	128	154	113	136
51. Uttar Kashi	47	5	53	64	47	136
52. Banda	382	41	423	508	548	93
53. Hamirpur	269	29	298	358	448	80
54. Jalaun	225	24	249	299	362	83
55. Jhansi	285	31	313	378	325	116
56. Lalitpur	145	16	161	193	212	91
Uttar Pradesh	26350	2830	29180	35016	30181	116

Appendix III.1(ii) : Normative Requirements of Foodgrains in
2001 : Madhya Pradesh

('000 metric tonnes)

District	Cereals	Pulses	Food- grains	Total Requi- rement	Foodgrain Output (Average 1983-86)	Food- grain Requi- ment As Per cent of Output
1	2	3	4	5	6	7
1. Raipur	651	78	721	865	949	91
2. Durg	447	48	495	594	472	126
3. Rajnandgaon	246	26	273	328	336	98
4. Bastar	406	44	450	540	549	98
5. Bilaspur	647	69	717	860	648	133
6. Sarguja	366	39	405	486	357	136
7. Raigarh	286	31	317	380	358	106
8. Jabalpur	1055	57	1111	1333	314	425
9. Balaghat	483	26	509	611	262	233
10. Chindwara	561	30	591	709	282	251
11. Seoni	355	19	374	449	199	226
12. Mandla	445	24	469	563	239	236
13. Narsinghpur	298	16	314	377	228	165
14. Sagar	301	32	333	400	320	125
15. Damoh	166	18	184	221	184	120
16. Panna	124	13	138	166	138	120
17. Tikamgarh	175	19	194	233	281	83
18. Chhatarpur	201	22	223	268	275	97
19. Rewa	272	29	301	361	253	143
20. Shidhi	232	25	256	307	202	152
21. Satna	267	29	295	354	236	150
22. Shahdol	323	35	358	430	231	186
23. Indore	714	38	753	904	226	400
24. Dhar	485	26	511	613	288	213
25. Jhabua	341	18	360	432	181	239
26. Khargone	553	30	583	700	289	242
27. Khandwa	758	41	799	959	213	450
28. Ujjain	266	28	294	353	335	105
29. Mandsaur	305	33	338	406	554	73
30. Ratlam	179	19	198	238	224	106
31. Dewas	196	211	217	260	258	101
32. Shajapur	190	20	210	252	329	77
33. Morena	635	34	669	803	341	235
34. Bhop	434	23	458	450	323	139

1	2	3	4	5	6	7
35. Gwalior	525	28	554	665	274	243
36. Shivpuri	407	22	429	515	280	184
37. Guna	470	25	495	584	344	173
38. Datia	139	7	146	175	119	147
39. Bhopal	240	26	266	319	128	249
40. Sehore	155	17	172	206	239	86
41. Raisen	168	18	186	223	301	74
42. Vidisha	168	18	186	223	367	61
43. Betul	213	23	235	282	252	112
44. Rajgarh	182	19	201	241	226	107
45. Hoshangabad	455	24	480	576	341	169
Madhya Pradesh	11940	1280	13220	15864	13818	115

CHAPTER IV

Output and Yield Trends

IV.1 Introduction

Having discussed the population trends and demand projections we may now turn our attention to the supply trends and possibilities. For purposes of our analysis supply is here treated as equivalent to domestic output. In this chapter we first discuss the output trends for different crops at the state level. Discussion of district level trends, which follows, is confined to the trends in output of total foodgrains only due to considerations of space and time. We then look at the situation with respect to the demand and supply balance in the year 2001 A.D. This is followed by an examination of the yield levels and trends and the supply possibilities.

IV.2 State and Crop Level Trends in Supply

For the purposes of projections in output the recent period trends are of greater relevance rather than the long period trends. We have, therefore, examined the trends in the output of major crops and crop groups in the post-green revolution period only, that is, since the late sixties till the mid-eighties. To eliminate the impact of agricultural fluctuations we have taken three years average of output centred around 1969-70 and 1984-85 in case of U.P. and around 1970-71 and 1983-84 in case of M.P. Compound annual growth rate in output are then computed over the period. This would give a fair indication of the trend rate of growth of agricultural output in the post-green revolution period. Trends in output growth over the period for different crops in U.P. and M.P. have been shown in Table IV.1 (i) and IV.1 (ii).

respectively, whereas yearwise output levels have been shown in Appendix IV.1(i) and IV.1(ii). In U.P. the rates of growth of total cereals and foodgrains output have been quite high - 4.52 and 3.64 per cent per annum respectively. The increase in output was contributed mainly by rice and wheat. The growth rate of coarse cereals - jowar, bajra and maize was quite slow, while the output of barley and small millets declined. A disconcerting aspect of the pattern of growth was a marked decline in pulse output. Among the non-foodgrain crops the growth of output of rapeseed and mustard, potato and tobacco was very high, while total oilseeds and sugarcane output registered a growth of slightly above 2 per cent per annum. On the other hand the output of ground nut, cotton and jute registered a decline. Thus, on the whole the growth performance of agricultural output has been fairly encouraging in the post-green revolution period, though certain cropwise imbalances are noticeable.

In case of Madhya Pradesh the growth rate of agricultural output has been relatively moderate. Thus, foodgrain output has grown at a rate of only 2.04 per cent during the period 1970-71 and 1983-84, which is less than the growth rate of population. Among the foodgrains the output of wheat, maize and gram has increased at a relatively higher rate, while the growth rate was low in case of rice, jowar and small millets and negative in case of bajra and barley. However, unlike U.P. the output of pulses has registered a positive growth trend in M.P. Among non-foodgrain crops growth of oilseeds and potato has been very high, while it was negative in case of groundnut, sugarcane, cotton and tobacco. Thus, the lack of irrigation facilities has restricted the ability of cultivators in Madhya Pradesh to fully benefit from the new agricultural technology.

Table IV.1 : Trends in Output of Major Crops in U.P. - 1968-69
to 1985-86

Crops	Output (Lakh tonnes) =====		Compound Rate of Growth (Per cent Per Annum)
	Average for 1968-71	1983-86	
Rice	32.27	74.16	5.71
Wheat	67.32	161.18	5.98
Jowar	4.58	5.10	0.70
Bajra	7.32	8.30	0.80
Maize	14.16	14.57	0.20
Barley	13.61	8.20	-2.27
Small Millets	4.94	3.55	-1.66
Total Cereals	141.79	275.03	4.52
Gram	16.32	12.53	-1.39
Arhar	6.88	7.65	0.70
Total Pulses	34.61	26.78	-1.39
Total Kharif Foodgrains	63.82	106.05	3.44
Total Rabi Foodgrains	112.57	194.84	3.72
Total Foodgrains	176.40	301.81	3.64
Total Oilseeds	3.73	5.11	2.12
Ground Nut	2.45	1.15	-3.33
Rapeseeds and Mustard	1.01	3.32	9.55
Sugarcane	552.99	740.57	2.28
Potato	15.55	49.82	9.36
Cotton	0.08	0.04	-3.22
Jute	0.17	0.12	-1.92
Tobacco	0.10	0.23	6.33

Source : Calculated from Agricultural Statistics of U.P. (Annual).

Table IV.2 : Trends in Output of Major Crops in M.P. - 1969-70
to 1984-85

Crops	Output (Lack tonnes) Average for =====		Compound Rate of Growth (Per cent Per Annum)
	1968-71	1983-86	
Rice	35.24	39.94	0.94
Wheat	26.42	40.38	3.33
Jowar	13.32	16.33	1.61
Bajra	1.22	1.18	-0.23
Maize	4.93	10.38	5.87
Barley	1.56	1.48	-0.38
Small Millets	3.18	3.66	1.08
Total Cereals	86.73	113.36	2.10
Gram	9.18	15.46	4.07
Arhar	3.67	4.18	1.01
Total Pulses	19.83	25.49	1.98
Total Kharif Foodgrains	65.01	78.26	1.41
Total Rabi Foodgrains	42.78	60.04	2.62
Total Foodgrains	106.57	138.18	2.04
Total Oilseeds	5.99	11.25	4.98
Ground Nut	2.95	2.01	-2.16
Rapeseeds and Mustard	0.64	2.04	9.34
Sugarcane	1.62	1.42	-0.94
Potato	1.76	3.40	5.15
Cotton	2.95	2.70	-0.59
Jute	-	-	-
Tobacco	0.02	0.01	-4.35

Source : Calculated from Agricultural Statistics of M.P. (Annual).

IV.3 District Level Trends in Supply

District level trends in the total foodgrains production in the post-green revolution period in U.P. and M.P. have been shown in Appendix IV.2(i) and IV.2(ii) respectively. Table IV.3 gives the distribution of districts according to the range of growth rate of output in the two states.

The process of agricultural growth was spatially quite widespread in U.P. with as many as 40 districts experiencing a growth rate of over 2.5 per cent per annum. By and large the high growth districts are found in the Gangetic plains where irrigation facilities are better developed. The increase in output was rather small in the majority of Hill districts (except Dehra Doon and Nainital) and moderate in Bundelkhand region (except Lalitpur district). A few relatively dry districts of South-West U.P. in the Western Region also showed moderate growth in output.

Table IV.3 : Distribution of Districts According to Rate of Growth of Foodgrains Output 1968-86 in Central Zone

Rate of Growth (Per cent per annum)	Uttar Pradesh	Madhya Pradesh
Upto 1.5	6	18
1.5 to 2.5	10	9
2.5 to 3.5	9	9
3.5 to 4.5	19	7
4.5 and Above	12	2
Total Districts	56	45

In contrast the growth rate in foodgrain output were generally lower in Madhya Pradesh and the process of growth was also regionally more concentrated. Only 18 out of 45 districts registered a growth rate of more than 2.5 per cent per annum. Generally the growth rates were higher in the northern and western parts of the state as compared to the southern and eastern parts. In 3 districts there was an actual decline in foodgrains output, while in another 15 districts the growth rate was less than 1.5 per cent per annum.

IV.4 Projected Demand and Supply

We may now look at the overall demand and supply on the basis of the demand trends discussed in Chapter III and supply trends discussed above. The expected level of requirements for different agricultural commodities in 2001 AD has been indicated in Table III.4(i) and III.4(ii). Assuming that the agricultural output will continue to grow at the same rate as observed in the recent past the scenario of demand and supply balance likely to emerge in 2001 AD would be as shown in Table IV.

The likely shortfall in the supply of total foodgrains would be of the order of 121.5 lakh tonnes or 22.5 per cent. The shortfall would be mainly in the case of coarse cereals and pulses. In case of rice and wheat output the supply is likely to exceed the demand. However, it would be difficult to sustain the high growth rate in the output of these two crops as future increases have to come more from yield increase rather than area increase. In terms of the sugarcane and oilseeds supply also U.P. is likely to remain a deficit state.

The magnitude of demand and supply gap is likely to be greater in case of Madhya Pradesh, where the shortage of total foodgrains is likely to be of the order of 63.8 lakh tonnes or

32.8 per cent. This shortfall is mainly to be seen in case of wheat and rice. In case of pulses and oilseeds there is likely to be a sizeable surplus. But in case of sugarcane the gap would be extremely large.

To maintain demand supply balance total foodgrains output should increase at an annual growth rate of 4.9 per cent in U.P. and 3.7 per cent in M.P. This compares with an observed growth rate of 3.6 and 2.0 in the two states respectively. Thus, the situation demands a substantial step up in the tempo of agricultural growth in the Central Zone during the nineties.

IV.5 Trends in Average Yields

Since the increase in agricultural output has to come basically from the increase in yield levels rather than an expansion of area, we may now look at the trends in average yields of major crops in the Central Zone. The growth of average yield of major crops in U.P. and M.P. during the post-green revolution phase has been shown in Table IV.5(i) and Table IV.5(ii) respectively.

In case of U.P. most of the crops show marked improvement in yield levels during the period, the growth rate being particularly sharp in case of rice, wheat, total cereals, total foodgrains, potato and tobacco. Even in case of coarse cereals whose output has remained stagnant yield levels show a definite improvement. Thus, while in case of cereals there has been a clear technological breakthrough in the state the yield levels of pulses, oilseeds and sugarcane show only a small improvement.

Like other dry regions the impact of the new agricultural technology has been rather moderate in M.P. The rate of increase in the average yield has been slow in case of most of the crops, with the exception of wheat, maize, rapeseed and mustard.

Table IV.4(i) : Estimates of Projected and Required Output and Rates of Growth of Agricultural Commodities : U.P.

Crop	Output in Lakh Tonnes (2000 - 2001)		
	Projected	Required	Required Output as Per cent of Projected
Rice	184.7	152.0	82.3
Wheat	419.1	350.9	83.6
Coarse Cereals	37.3	68.6	184.1
Total Cereals	566.6	575.4	101.4
Total Pulses	20.1	39.7	197.5
Total Foodgrains	540.2	661.7	122.5
Total Oilseeds	7.2	31.8	441.7
Sugarcane	1066.4	1848.0	172.3

Note : Projected output has been estimated separately for each crop/crop group on the basis of the observed growth rate between 1970-71 and 1983-84. Hence totals do not tally. For details of the methodology of estimating required output see Chapter III.

Table IV.4(ii) : Estimates of Projected and Required Output and Rates of Growth of Agricultural Commodities : M.P.

Crop	Output in Lakh Tonnes (2000 - 2001)		
	Projected	Required	Required Output as Per cent of Projected
Rice	46.7	86.2	184.6
Wheat	71.1	101.9	143.3
Coarse Cereals	56.3	59.9	106.4
Total Cereals	162.1	241.9	149.2
Total Pulses	35.7	13.6	38.1
Total Foodgrains	194.8	258.6	132.8
Total Oilseeds	26.3	10.8	41.1
Sugarcane	11.8	77.0	6.5

Table IV.5(i) : Trends in Average Yield of Major Crops in
U.P. : 1968-69 to 1985-86

Crops	Average Yield (Qtl/Hect)		Compound Rate of Growth (Per cent Per Annum)
	1968-71	1983-86	
Rice	7.42	13.53	4.07
Wheat	12.30	19.21	3.01
Jowar	6.00	7.91	1.87
Bajara	6.86	8.74	1.61
Maize	9.60	12.51	1.76
Barley	9.51	13.90	2.56
Small Millets	6.54	8.48	1.76
Total Cereals	9.40	15.58	3.44
Gram	7.53	8.80	1.05
Arhar	11.59	14.35	1.55
Total Pulses	8.40	9.04	0.51
Total Kharif Foodgrains	7.45	11.97	3.23
Total Rabi Foodgrains	10.59	16.84	3.14
Total Foodgrains	9.03	14.64	3.27
Oilseeds	5.63	6.07	0.51
Ground Nut	7.08	6.36	-0.64
Rapeseeds and Mustard	5.33	6.83	1.66
Sugarcane	422.70	470.59	0.70
Potato	95.19	160.59	3.56
Cotton	1.56	1.49	-0.26
Jute	13.91	17.18	1.44
Tobacco	8.72	14.43	3.39

Table IV.5(ii) : Trends in Average Yield of Major Crops in
M.P. : 1969-70 to 1982-85

Crops	Average Yield (Qtl/Hect)		Compound Rate of Growth (Per cent Per Annum)
	1969-72	1982-85	
Rice	8.03	8.17	0.15
Wheat	7.62	11.07	2.90
Jowar	6.24	7.72	1.67
Bajara	5.64	7.00	1.67
Maize	8.14	12.73	3.48
Barley	9.04	9.55	0.45
Small Millets	2.25	2.54	0.94
Total Cereals	6.95	8.65	1.67
Gram	5.70	7.08	1.67
Arhar	7.42	8.43	1.01
Total Pulses	4.73	5.12	0.67
Total Kharif Foodgrains	6.25	7.15	1.01
Total Rabi Foodgrains	6.57	8.33	1.86
Total Foodgrains	6.34	7.65	1.48
Oilseeds	3.12	4.61	3.06
Ground Nut	6.51	6.26	-0.30
Rapeseeds and Mustard	3.11	6.54	5.87
Sugarcane	27.02	34.42	1.86
Potato	109.07	117.18	0.52
Cotton	4.29	4.94	1.08
Jute	-	-	-
Tobacco	8.95	4.72	-3.01

District-wise growth rate in average yield of foodgrains in U.P. and M.P. has been shown in Appendix IV.4(i) and IV.4(ii) respectively. Table IV.6 shows the distribution of districts according to the level of growth rate of average yields in the two states. Growth rates of yields were fairly encouraging in U.P., where in as many as 32 districts the growth rate in yield exceeded 3 per cent per annum. In another 18 districts of U.P. the growth rate of yield was between 1 and 3 per cent per annum. However, four districts belonging to U.P. Hills registered a moderate decline in yield levels.

In contrast the performance of districts of Madhya Pradesh in respect of yield growth was less satisfactory. In 3 districts the growth rate was negative and in 10 districts it was less than 1 per cent per annum. Majority of districts fall in the category of moderate growth rate (i.e. between 1 and 3 per cent) per annum. But in 6 districts growth rate of yield exceeded 3 per cent per annum.

Table IV.6 : Distribution of Districts According to Growth Rate of Average Yield of Foodgrains : 1969-1986
(Nos.)

Rate of Growth (Per cent Per Annum)		Uttar Pradesh	Madhya Pradesh
Negative		4	3
Upto	1.0	2	12
Between	1.0 & 3.0	18	24
Between	3.0 & 5.0	31	6
Above	5.0	2	-
All Districts		56	45

IV.6 Supply Possibilities

We have indicated above the urgent need of raising the rate of growth of agricultural output in the Central Zone to keep pace with the rising level of demand. We may now briefly look at the supply possibilities in the Zone. An idea of the large potential of agricultural development can be had from the comparative study of the yield levels and spread of modern technology in the Zone.

In Table IV.7 we have indicated the comparative yield of major crops in U.P. and M.P. in relation to Punjab and India. While comparison between U.P. and Punjab, where irrigation facilities are more developed, indicates the yield potential of U.P., in case of M.P., where irrigation is less developed, comparison with national average may be more relevant.

Except in the case of pulses we find a significant gap between the yield levels in U.P. and Punjab. In many cases Punjab yields are nearly double of U.P. yields. In case of oilseeds and sugarcane U.P. is even lagging behind India. In Madhya Pradesh the yield levels are much lower than the national average.

The foodgrain yield per hectare is only 765 kg. in M.P. and 1464 kg. in U.P. as compared to 3016 kg. in Punjab. In as many as 36 districts of M.P. and 5 districts of U.P. the average yield of foodgrains is below 1000 kg. (Table IV.8 and Appendix IV.5(i) and IV.5(ii)).

Thus the gap between the known agricultural technology and the technology in use is very large in case of both the states of the Central Zone. The relatively slower spread of the new agricultural technology in the Central Zone is further evident from the relatively lower level of use of modern inputs in the Zone (Table IV.9). In terms of adoption of HYV seeds and chemical fertilisers and use of tractors, pumpsets and irrigation water in

**Table IV.7 : Comparative Yield of Major Crops in Central Zone :
1983-86**

(Qtls./ha.)

Crops	Uttar Pradesh	Madhya Pradesh	Punjab	India
Rice	13.53 (43.50)	8.17 (26.27)	31.10 (100.0)	14.80 (47.59)
Wheat	19.21 (58.57)	11.07 (33.75)	32.80 (100.0)	13.20 (40.24)
Jowar	7.91 (-)	7.72 (-)	- -	- -
Bajra	8.74 (85.35)	7.00 (68.36)	10.24 (100.0)	5.30 (51.76)
Maize	12.51 (71.08)	12.73 (72.33)	17.60 (100.0)	13.26 (75.34)
Barley	13.90 (76.88)	9.55 (52.82)	18.08 (100.0)	13.30 (73.56)
Small Millets	8.48 (-)	2.54 (-)	- -	- -
Total Cereals	15.58 (50.14)	8.65 (27.84)	31.07 (100.0)	13.08 (42.10)
Gram	8.80 (124.65)	7.08 (100.28)	7.06 (100.0)	6.90 (97.73)
Arhar	14.55 (142.09)	8.43 (82.32)	10.24 (100.0)	7.92 (77.34)
Total Pulses	9.04 (133.93)	5.12 (75.85)	6.75 (100.0)	5.40 (80.00)
Total Foodgrains	14.64 (48.54)	7.65 (25.36)	30.16 (100.0)	11.66 (38.66)
Oilseeds	6.07 (65.69)	4.61 (49.89)	9.24 (100.0)	6.66 (72.08)
Groundnut	6.36 (72.85)	6.26 (71.71)	8.73 (100.0)	8.66 (99.20)
Rapeseeds				
Mustard	6.83 (68.30)	6.54 (65.40)	10.00 (100.0)	6.75 (67.50)
Sugarcane	470.59 (72.87)	344.20 (5.33)	645.83 (100.0)	578.43 (89.56)
Potato	160.59 (82.84)	117.18 (60.45)	193.85 (100.0)	142.24 (73.38)

Source : Calculated from Agricultural Statistics of U.P., (Annual).

Note : Figures in parentheses show comparative yields in relation to yields in Punjab.

Table IV.8 : Distribution of Districts by Average Yield of Foodgrains in Central Zone, 1983-86

(Nos.)

Average Yields (Kg. Per Hectare)	Uttar Pradesh	Madhya Pradesh
Upto 750	-	23
Between 750 and 1000	5	15
Between 1000 and 1250	9	6
Between 1250 and 1500	17	7
Between 1500 and 1750	9	-
Between 1750 and 2000	7	-
Above 2000	7	-
All Districts	56	45

U.P. is still way behind agriculturally progressive state of Punjab. In case of M.P. the differences are even more stark.

To conclude, the present level of average yields and modern agricultural inputs in the Central Zone in relation to states like Punjab indicate the large possibilities of raising agricultural output in both the states. A doubling of output in the next two decades does not seem to be an unrealistic target. The major constraint appear to be the preponderance of small and marginal holdings and the development of irrigation facilities. While the former constraint can be met by better organisational efforts to provide infrastructural and input support to the small and marginal farmers, urgent efforts are required to develop the considerable unexploited irrigation potential that exists in both the states of the Central Zone.

Table IV.9 : Indicators of Agricultural Development in the Central Zone, Early 1980s

Indicators	Uttar Pradesh	Madhya Pradesh	Punjab	India
1. Average Size of Holding 1980-81	1.0	3.4	3.8	1.8
2. Proportion of Small and Marginal Holdings 1980-81	86.9	51.9	38.6	74.6
3. Proportion of Area Under Small and Marginal Holdings 1980-81	48.3	12.4	10.2	26.2
4. Gross Area Irrigated As Per cent of Gross Sown Area, 1980-83	45.1	12.6	98.6	31.0
5. Per cent Coverage of Area Under HYV, 1980-83				
(i) Paddy	48.6	30.3	94.3	47.7
(ii) Wheat	77.8	32.7	98.9	74.6
(iii) Maize	3.6	17.8	35.7	27.9
6. Fertiliser Consumption Kg.Per Ha., 1980-83	52.4	11.2	129.2	35.9
7. Tractors Per '000 ha., 1980-83	2.5	0.8	11.0	1.7
8. Pumpsets Per '000 ha.	25.3	13.2	74.8	29.6

Source : For items 1 to 3 Census of Agricultural Holdings, 1980-81, and for items 4 to 8 G.S. Bhalla and D.S. Tyagi, Pattern in Indian Agricultural Development - A District level Study, Institute for Studies in Industrial Development, New Delhi, 1989.

Appendix IV.1(i) : Trends in Output of Major Crops in Uttar Pradesh : 1968-69 to 1985-86

(Thousand Metric Tonnes)

Year	Rice	Wheat	Jowar	Bajra	Maize	Barley	Small Millets	Total Cereals	Gram	Arhar	Total Pulses
1968-69	2746	6087	454	573	1277	1150	474	12759	1545	691	3282
1969-70	3334	6421	433	741	1174	1203	480	14083	1806	694	3330
1970-71	3605	7690	436	882	1799	1430	506	16398	1544	679	3069
1971-72	3777	7550	228	529	873	1359	468	14753	1567	599	2920
1972-73	3272	7515	524	720	1357	1299	522	15210	1461	869	2922
1973-74	3859	5879	472	790	1088	1166	460	13714	1044	310	1850
1974-75	3453	7176	414	492	823	1366	420	14143	1009	618	2185
1975-76	4294	8552	462	726	1014	1374	376	16799	1250	775	2657
1976-77	4291	8940	464	790	1097	1168	490	17280	1362	752	2629
1977-78	5203	9884	551	658	952	1070	479	18814	1207	750	2421
1978-79	5964	11458	481	581	806	1001	435	20743	1228	646	2365
1979-80	2557	9895	166	367	913	719	253	14883	693	539	1556
1980-81	5569	13385	406	733	894	1032	387	22421	1288	756	2526
1981-82	5898	12751	605	679	1004	744	335	22026	1061	630	2557
1982-83	5646	15258	284	741	837	834	331	23942	1395	562	2268
1983-84	6777	16121	545	901	1111	367	362	26701	1186	715	2499
1984-85	7157	15675	566	949	1779	742	345	27213	1272	842	2705
1985-86	8315	16559	420	640	1473	824	363	28594	1300	739	2832

Contd.../-

Appendix IV.1(i) (Contd.)

Year	Total Kharif Food- grains	Total Rabi Food- grains	Total Food- grains	Total Oil- seeds	Ground- nut	Rapeseeds and Mus- tard	Sugarcane	Potato	Cotton	Jute	Tobacco
1968-69	5584	10454	16041	352	252	81	50543	1632	7	16	9
1969-70	6224	11187	17013	387	261	97	60679	1249	9	15	12
1970-71	7331	12132	19467	380	222	126	54672	1486	8	19	10
1971-72	5874	11795	17673	310	183	102	49354	1680	5	18	10
1972-73	6456	11674	18133	431	287	119	56727	1603	7	17	11
1973-74	6733	8827	15563	437	286	123	60773	1721	5	14	9
1974-75	5664	10660	16328	601	351	215	61479	2139	3	13	6
1975-76	6921	12533	19456	507	313	156	58359	2507	3	83	9
1976-77	7195	12690	19909	376	233	117	65216	2329	2	12	13
1977-78	7902	13313	21235	444	244	165	76819	3025	2	18	12
1978-79	8312	14748	23108	375	181	162	62324	4296	3	16	10
1979-80	4291	12100	16439	192	96	89	51228	3163	6	14	14
1980-81	8046	16832	24948	373	133	220	64205	4165	5	13	20
1981-82	8594	15629	24294	577	354	292	76440	4380	4	14	15
1982-83	7885	18512	26499	419	186	206	81387	4287	5	13	18
1983-84	9740	19377	29199	688	151	246	78244	5557	3	10	15
1984-85	10830	19006	29918	964	89	785	70286	5449	4	11	26
1985-86	11269	20069	31426	504	105	355	73037	3740	5	15	22

Source : Agricultural Statistics of Uttar Pradesh, (Annual).

Appendix IV.1(iii) : Trends in Output of Major Crops in Madhya Pradesh : 1968-69 to 1986-87

(Thousand Metric Tonnes)

Year	Rice	Wheat	Jowar	Bajra	Maize	Barley	Small Millets	Total Cereals	Gram	Arhar	Total Pulses
1968-69	2898	1964	1579	115	335	122	336	7393	726	254	1547
1969-70	3225	2293	1391	140	393	179	356	8029	849	310	1756
1970-71	3696	2592	1336	120	627	152	316	8931	855	409	1990
1971-72	3702	3189	1244	119	484	173	326	9282	1148	425	2349
1972-73	3083	2285	1746	145	616	161	302	8376	1108	475	2250
1973-74	3647	2539	1177	213	432	163	354	8572	1056	292	2068
1974-75	2421	2351	1871	89	527	203	283	7787	1144	419	2218
1975-76	3844	2750	1349	119	736	213	394	9461	1226	432	2520
1976-77	2797	2308	1282	124	738	121	247	7666	1049	281	1883
1977-78	4437	3103	1461	92	574	198	384	10295	907	352	2002
1978-79	3562	3523	1250	119	599	209	270	9605	1032	317	2036
1979-80	1826	2155	1109	35	541	89	148	5928	924	299	1517
1980-81	4053	3143	1815	121	713	236	277	10401	1063	304	2011
1981-82	3830	3313	1859	79	770	166	299	10358	1362	482	2473
1982-83	3451	3801	1401	105	804	153	250	10007	1644	335	2608
1983-84	4799	4374	1983	123	1156	168	352	13002	1425	510	2702
1984-85	3761	3935	1520	126	1161	124	287	10951	1303	101	2343
1985-86	5418	4202	1750	89	709	127	365	12683	1557	410	2610
1986-87	4178	4264	1291	124	761	148	252	11028	1480	413	2493

Contd.../-

Appendix IV.1(ii) (Contd.)

Year	Total Kharif Food- grains	Total Rabi Food- grains	Total Food- grains	Total Oil- seeds	Ground- nut	Rapeseeds and Mus- tard	Sugarcane	Potato	Cotton	Tobacco
1968-69	5758	3182	8940	500	230	53	142	192	430	1.2
1969-70	6102	3683	9785	535	286	61	169	185	324	1.3
1970-71	6823	4098	10921	626	334	60	161	195	209	1.2
1971-72	6578	5053	11631	656	293	92	144	174	369	1.2
1972-73	6614	4012	10626	654	292	99	137	166	330	1.2
1973-74	6389	4251	10640	651	211	114	152	186	169	1.2
1974-75	5880	4125	10005	771	299	142	200	261	401	0.9
1975-76	7225	4756	11981	866	407	127	246	217	272	1.5
1976-77	5764	3785	9549	570	326	47	232	196	278	1.7
1977-78	7624	4673	12297	646	248	85	169	230	299	1.3
1978-79	6424	5217	11641	641	220	93	179	271	297	0.9
1979-80	4082	3363	7445	534	169	47	111	213	246	0.5
1980-81	7569	4843	12412	608	180	143	107	391	269	1.0
1981-82	7629	5202	12831	833	227	159	121	310	316	0.7
1982-83	6630	5985	12615	797	179	140	136	306	317	0.5
1983-84	9288	6416	15704	1164	232	232	148	333	210	0.7
1984-85	7561	5734	13295	1378	160	242	134	376	269	0.6
1985-86	8994	6299	15293	1416	170	182	122	272	270	0.0
1986-87	7268	6253	13521	1252	189	208	165	345	227	0.0

Source : Agricultural Statistics Madhya Pradesh, (Annual).

Appendix IV.2(i) : Districtwise Trends in Foodgrains Output :
Uttar Pradesh (1968-69 to 1985-86)

Sl. District No.	Output in '000 tonnes		Per cent Increase	Annual Compound Growth Rate (%)	
	1969-77	1982-85			
0	1	2	3	4	5
1. Agra		389	560	44	2.46
2. Aligarh		673	915	36	2.07
3. Bareilly		280	595	12	5.14
4. Bijnor		250	420	68	3.52
5. Budaun		363	693	71	4.41
6. Bulandshahr		569	954	68	3.52
7. Etah		438	611	39	2.22
8. Etawah		397	566	43	2.41
9. Farrukhabad		325	576	78	3.92
10. Ghaziabad		209	399	91	4.41
11. Meerut		516	558	76	3.84
12. Mainpuri		390	592	52	2.83
13. Mathura		382	582	52	2.83
14. Moradabad		457	852	87	4.26
15. Muzaffarnagar		304	553	82	4.07
16. Pilibhit		200	533	166	6.74
17. Rampur		237	483	103	4.84
18. Saharanpur		347	699	101	4.77
19. Shahjahanpur		283	759	168	6.79
20. Barabanki		332	570	72	3.68
21. Fatehpur		289	522	81	4.03
22. Hardoi		404	671	66	3.44
23. Kanpur		485	878	81	4.03
24. Lakhimpur Kheri		286	571	99	4.69
25. Lucknow		158	230	45	2.51
26. Rae Bareli		298	506	70	3.60
27. Sitapur		360	492	37	2.12
28. Unnao		312	468	50	2.74
29. Allahabad		426	854	101	6.79
30. Azamgarh		394	810	105	4.99
31. Bahraich		420	587	40	2.27
32. Ballia		242	394	40	3.31
33. Basti		606	958	58	3.10
34. Deoria		430	893	108	5.00
35. Faizabad		293	679	132	5.77
36. Ghazipur		253	453	79	3.96
37. Gonda		489	844	73	3.72
38. Gorakhpur		519	958	85	4.19
39. Jaunpur		336	614	83	4.11
40. Mirzapur		297	458	54	2.92
41. Pratapgarh		232	420	82	4.07
42. Sultanpur		273	571	109	5.04
43. Varanasi		338	612	81	4.03

Contd.../-

Appendix IV.2(i) (Contd.)

0	1	2	3	4	5
44. Almora		156	174	11	0.70
45. Chamoli		82	69	-16	-0.99
46. Dehra Dun		55	91	65	3.39
47. Nainital		291	591	103	4.84
48. Pithoragarh		120	135	12	0.76
49. Pauri Garhwal		137	137	1	0.07
50. Tehri Garhwal		97	113	17	1.05
51. Uttar Kashi		46	47	4	0.26
52. Banda		400	548	37	2.12
53. Hamirpur		350	448	28	1.66
54. Jalaun		267	362	36	2.07
55. Jhansi		250	326	30	1.76
56. Lalitpur		118	212	80	4.00
Uttar Pradesh		17640	30181	71	3.64

Source : Calculated from Agricultural Statistics, U.P..
(Annual).

Appendix IV.2(ii) : Districtwise Trends in Foodgrains Output :
Uttar Pradesh (1968-69 to 1985-86)

Sl. District No.	Output in '000 tonnes =====		Per cent Increase	Annual Compound Growth Rate (%)
	1969-77	1982-85		
1. Raipur	846	949	12	0.88
2. Durg	391	472	21	1.48
3. Rajnandgaon	300	335	12	0.88
4. Bastar	437	549	26	1.79
5. Bilaspur	661	648	-2	-0.15
6. Sarguja	316	357	13	0.94
7. Raigarh	295	358	21	1.48
8. Jabalpur	274	314	14	1.01
9. Balaghat	284	262	-8	-0.59
10. Chindwara	238	383	61	3.73
11. Seoni	203	199	-2	-0.15
12. Mandla	205	239	16	1.15
13. Narsinghpur	175	228	31	2.10
14. Sagar	266	320	20	1.41
15. Damoh	161	184	14	1.01
16. Panna	106	138	30	2.04
17. Tikamgarh	149	281	89	5.02
18. Chhatarpur	190	275	45	2.90
19. Rewa	217	253	17	1.22
20. Shindhi	175	202	15	1.08
21. Satna	197	236	20	1.41
22. Shahdol	218	231	16	0.45
23. Indore	171	226	32	2.16
24. Dhar	209	288	38	2.51
25. Jhabua	134	181	35	2.34
26. Khargone	242	289	19	1.35
27. Khandwa	177	213	20	1.41
28. Ujjain	244	335	37	2.45
29. Mandsaur	255	554	118	6.18
30. Ratlam	127	224	76	4.44
31. Dewas	174	258	49	3.12
32. Shajapur	219	329	50	3.17
33. Morena	260	341	31	2.10
34. Bhind	253	323	28	1.92
35. Gwalior	165	274	66	3.98
36. Shivpuri	170	280	65	3.93
37. Guna	224	344	53	3.33
38. Datia	67	119	77	4.49
39. Bhopal	80	128	60	3.68
40. Sehare	164	239	46	2.95
41. Raisen	208	301	45	2.90
42. Vidisha	263	367	39	2.57
43. Bitul	193	252	31	2.10
44. Rajgarh	161	226	40	2.62
45. Hushangabad	193	314	63	3.83

Source : Calculated from Agricultural Statistics, M.P.,
(Annual).

Appendix IV.3(i) : Trends in Yield of Major Crops in Uttar Pradesh : 1968-69 to 1985-86

(Quintals Per Hectare)

Year	Rice	Wheat	Jowar	Bajra	Maize	Barley	Small Millets	Total Cereals	Gram	Arhar	Total Pulses
1968-69	6.44	12.01	5.50	5.42	8.95	7.71	6.05	8.56	7.07	11.11	8.19
1969-70	7.64	11.78	5.95	7.26	7.87	10.16	6.31	9.21	8.04	11.98	8.42
1970-71	8.16	13.02	6.62	7.87	11.93	10.81	7.00	10.42	7.43	11.65	8.24
1971-72	8.00	12.49	3.61	3.58	5.70	10.36	6.90	9.33	7.88	12.81	8.28
1972-73	7.48	12.25	7.19	6.63	9.15	10.09	7.19	9.61	7.61	15.40	8.33
1973-74	8.63	9.78	6.70	7.43	7.24	9.20	6.70	8.74	5.34	5.86	5.32
1974-75	7.80	11.66	5.77	4.92	5.98	11.09	6.97	9.12	5.87	11.44	6.94
1975-76	9.29	13.59	6.51	7.21	7.27	11.43	6.58	10.62	7.24	14.67	3.42
1976-77	9.22	13.50	6.88	7.80	8.29	10.86	7.43	10.75	8.21	14.16	8.62
1977-78	10.69	14.62	8.18	6.70	7.98	11.11	7.74	11.70	7.29	14.41	8.10
1978-79	11.59	15.50	7.31	6.25	6.85	11.52	7.23	12.35	7.48	12.90	7.62
1979-80	5.06	13.14	2.44	3.52	7.91	9.15	4.93	8.87	4.46	9.94	5.29
1980-81	10.53	16.50	5.99	7.37	7.31	13.25	7.53	12.73	8.61	14.48	8.84
1981-82	10.94	16.40	8.81	6.97	8.55	10.80	7.61	12.83	6.75	12.23	7.44
1982-83	11.15	18.39	5.03	7.76	7.01	13.31	7.52	14.04	9.26	11.70	8.58
1983-84	12.66	18.90	8.45	8.67	10.04	14.26	8.09	15.05	8.73	13.82	8.82
1984-85	13.00	18.69	8.59	10.02	15.17	13.09	8.16	15.41	9.26	16.19	9.37
1985-86	14.88	20.00	6.67	7.41	12.18	13.90	9.28	16.29	8.66	13.61	8.93

Contd.../-

Appendix IV.3(i) (Contd.)

Year	Total Kharif Food- grains	Total Rabi Food- grains	Total Food- grains	Total Oil- seeds	Ground- nut	Rapeseeds and Mus- tard	Sugarcane	Potato	Cotton	Jute	Tobacco
1968-69	6.36	10.05	8.48	5.59	7.06	4.86	420.19	93.84	1.53	14.03	7.55
1969-70	7.30	10.43	9.05	5.85	7.69	5.03	440.80	70.66	1.73	13.65	9.36
1970-71	8.45	11.25	10.00	5.45	6.50	5.96	406.42	90.00	1.49	14.03	9.13
1971-72	6.82	11.01	9.14	4.31	5.60	3.74	387.35	94.10	0.83	14.94	8.79
1972-73	7.54	10.85	9.28	6.51	9.10	5.38	433.70	93.14	1.41	15.90	9.76
1973-74	7.84	8.35	8.12	6.02	8.12	5.13	412.65	92.04	1.26	16.11	8.27
1974-75	6.83	10.29	8.75	6.58	8.47	6.44	412.19	104.43	1.17	14.42	7.62
1975-76	8.17	11.95	10.26	5.75	7.37	5.35	405.08	131.29	0.95	10.84	7.98
1976-77	8.46	11.98	10.41	4.65	5.99	2.19	447.94	127.58	1.01	16.95	9.20
1977-78	9.29	12.63	11.14	5.29	7.42	4.68	469.14	149.86	0.88	15.78	10.81
1978-79	9.55	13.31	11.61	4.80	5.57	5.29	381.64	155.10	0.85	15.07	11.18
1979-80	4.95	11.05	8.34	3.35	3.97	3.92	373.17	130.81	1.57	15.47	13.24
1980-81	4.02	14.75	12.19	5.27	7.01	5.40	470.90	156.66	1.27	14.63	13.11
1981-82	9.60	14.04	12.01	1.72	9.17	6.35	462.69	155.24	1.26	17.93	12.86
1982-83	9.49	16.04	13.24	5.00	6.24	5.04	456.55	158.21	1.36	16.75	13.69
1983-84	11.07	16.72	14.19	6.34	6.48	7.07	462.54	185.55	1.42	17.33	14.48
1984-85	12.18	16.56	14.56	10.92	4.78	7.64	459.36	170.00	1.89	19.78	15.44
1985-86	12.66	17.23	15.16	5.63	8.47	6.26	490.19	131.69	1.60	20.54	14.24

Appendix IV.3(ii) : Trends in Yields of Major Crops in Madhya Pradesh : 1968-69 to 1986-87

(Quintal Per Hectare)

Year	Rice	Wheat	Jowar	Bajra	Maize	Barley	Small Millets	Total Cereals	Gram	Arhar	Total Pulses
1968-69	7.11	6.80	6.60	4.78	5.74	6.28	2.17	5.96	4.86	5.23	3.96
1969-70	7.64	7.14	6.05	6.03	6.85	9.55	2.23	6.30	5.32	6.58	4.38
1970-71	8.93	7.94	6.16	5.42	10.76	9.70	2.08	7.08	5.29	8.21	4.68
1971-72	8.66	9.07	6.06	6.02	8.22	10.02	2.25	7.29	6.82	8.53	5.40
1972-73	7.16	7.27	7.88	6.50	9.98	8.95	2.10	6.60	6.83	9.03	5.16
1973-74	8.49	8.09	5.81	9.76	7.00	8.55	2.41	6.85	5.71	5.68	4.33
1974-75	5.65	8.80	8.93	4.92	8.13	9.61	1.90	6.42	6.22	8.17	5.02
1975-76	8.86	8.54	6.84	6.06	11.50	10.44	2.61	7.48	6.40	8.38	5.29
1976-77	6.38	7.66	6.82	6.41	11.01	7.62	1.68	6.20	5.20	5.53	4.00
1977-78	9.91	9.11	7.54	5.77	8.31	11.18	2.64	7.98	5.10	7.25	4.59
1978-79	7.81	9.73	6.89	6.72	8.62	11.19	6.63	7.33	5.94	6.71	4.48
1979-80	4.03	7.28	5.12	2.04	7.26	4.06	1.14	4.70	4.25	4.49	3.25
1980-81	8.81	9.74	7.74	6.09	9.24	11.93	2.11	7.87	5.87	5.83	4.39
1981-82	8.36	10.46	8.27	4.57	9.86	9.15	2.27	7.95	6.72	9.07	5.08
1982-83	7.31	11.04	6.90	6.15	10.22	9.26	1.92	7.65	6.89	6.78	5.07
1983-84	10.27	12.07	9.34	7.09	14.03	10.55	2.68	9.64	6.77	10.09	5.42
1984-85	8.02	11.41	7.98	7.77	13.79	8.75	2.28	8.41	6.28	8.17	4.84
1985-86	11.40	11.83	9.07	5.41	8.51	8.81	2.60	9.57	6.23	8.59	5.07
1986-87	8.77	12.71	6.82	7.50	9.02	10.87	1.89	8.52	6.68	9.51	5.22

Appendix IV.3(ii) (Contd.)

Year	Total Kharif Food- grains	Total Rabi Food- grains	Total Food- grains	Total Oil- seeds	Ground- nut	Rapeseeds and Mus- tard	Sugarcane	Potato	Cotton	Tobacco
1968-69	5.47	5.49	5.48	2.72	4.65	3.38	25.56	104.75	2.59	4.87
1969-70	5.79	5.94	5.84	3.26	7.03	3.34	25.11	107.32	2.54	5.31
1970-71	6.55	6.36	6.48	3.25	7.20	2.96	26.59	125.94	1.66	5.46
1971-72	6.40	7.42	6.81	3.17	6.02	5.92	27.71	107.56	2.89	5.42
1972-73	6.18	6.30	6.23	3.43	6.71	4.69	26.41	91.75	2.64	4.79
1973-74	6.06	6.30	6.16	3.01	4.80	4.83	26.68	100.52	1.54	4.89
1974-75	5.52	7.00	6.05	3.53	6.68	5.40	29.75	128.95	3.61	5.13
1975-76	6.82	6.97	6.88	4.04	8.30	5.27	30.56	111.58	2.24	5.60
1976-77	5.45	5.84	5.60	2.89	6.27	2.61	30.07	100.71	2.36	5.45
1977-78	7.15	6.69	7.04	3.10	5.67	3.38	30.11	116.56	2.25	5.24
1978-79	6.05	7.42	6.60	2.98	5.38	3.89	28.96	111.53	2.27	5.34
1979-80	3.76	5.23	4.31	1.90	5.29	2.50	21.62	99.96	2.07	3.99
1980-81	6.74	7.37	6.97	3.36	6.10	6.10	27.43	158.31	2.28	4.93
1981-82	6.88	7.65	7.17	4.07	7.56	5.49	28.42	110.52	2.76	5.18
1982-83	8.11	8.11	6.92	3.63	5.13	5.05	28.74	112.00	2.85	4.83
1983-84	8.35	8.74	8.50	3.93	7.45	7.49	33.12	114.29	2.15	5.46
1984-85	6.99	8.14	7.44	4.98	5.32	6.87	32.61	123.59	2.68	4.87
1985-86	8.22	8.43	8.31	4.98	6.62	5.41	16.71	100.74	2.72	0.00
1986-87	6.74	9.02	7.63	4.56	7.74	6.31	20.12	123.21	2.35	0.00

Source : Agricultural Statistics of Madhya Pradesh, (Annual).

Appendix IV.4(i) : Growth Rates of Foodgrain Yields :
U.P. (1968-86)

Sl. No.	Districts	Average Yield (Qtl./Ha.)		Index	Compound Growth Rate (Per cent Per Annum)
		1968-71	1983-86		
0	1	2	3	4	5
1.	Agra	10.33	16.43	159	3.14
2.	Aligarh	13.29	17.34	130	1.76
3.	Bareilly	8.41	15.55	185	4.19
4.	Bijnor	9.35	17.68	189	4.34
5.	Budaun	8.76	14.72	168	3.52
6.	Bulandshahr	12.79	22.24	174	3.76
7.	Etah	11.52	15.07	131	1.82
8.	Etawah	11.56	15.75	136	2.07
9.	Farrukhabad	10.50	18.01	192	3.68
10.	Ghaziabad	11.41	21.04	184	4.15
11.	Meerut	14.39	23.95	166	3.44
12.	Mainpuri	11.15	16.04	144	2.46
13.	Mathura	11.50	18.11	157	3.05
14.	Moradabad	9.67	17.33	179	3.96
15.	Muzaffarnagar	12.49	23.53	188	4.30
16.	Pilibhit	9.24	18.82	204	4.87
17.	Rampur	10.77	20.24	188	4.30
18.	Saharanpur	10.31	20.64	200	4.73
19.	Shahjahanpur	8.46	17.51	207	4.97
20.	Barabanki	8.94	14.11	158	3.10
21.	Fatehpur	8.90	14.13	159	3.14
22.	Hardoi	9.93	13.93	140	2.27
23.	Kanpur	10.42	17.62	169	3.56
24.	Lakhimpur-Kheri	6.90	12.74	185	4.19
25.	Lucknow	9.18	13.12	143	2.41
26.	Rae Bareli	8.66	13.69	158	3.10
27.	Sitapur	8.10	10.55	130	1.76
28.	Unnao	8.98	13.09	146	2.56
29.	Allahabad	7.76	14.06	181	4.03
30.	Azamgarh	8.03	14.23	177	3.88
31.	Bahraich	7.51	9.38	125	1.50
32.	Ballia	8.75	12.72	145	2.51
33.	Basti	8.54	12.12	142	2.37
34.	Deoria	8.17	16.44	201	4.77
35.	Faizabad	8.02	16.71	208	5.00
36.	Ghazipur	8.29	14.19	171	3.64
37.	Gonda	7.38	11.92	162	3.27
38.	Gorakhpur	9.15	14.35	157	3.05
39.	Jaunpur	10.00	15.65	157	3.05
40.	Mirzapur	7.72	10.15	131	1.82
41.	Pratapgarh	8.29	13.65	165	3.39
42.	Sultanpur	7.77	13.13	195	4.55
43.	Varanasi	8.84	14.51	164	3.35

Contd.../-

Appendix IV.4(i) (Contd.)

0	1	2	3	4	5
44. Almora		10.76	9.55	89	-0.70
45. Chamoli		12.83	11.07	86	-0.88
46. Dehradun		8.87	13.41	151	2.79
47. Nainital		12.92	22.06	171	3.64
48. Pithoregarh		11.63	11.32	97	-0.20
49. Pauri Garhwal		10.46	9.68	93	-0.45
50. Tehri Garhwal		10.39	10.68	103	0.20
51. Uttar Kashi		11.95	12.59	105	0.33
52. Banda		7.14	9.39	132	1.67
53. Hamirpur		7.23	8.99	124	1.44
54. Jalaun		7.41	10.68	144	2.46
55. Jhansi		8.19	10.23	125	1.50
56. Lalitpur		6.50	9.53	147	2.60
Uttar Pradesh		9.02	14.64	162	3.27

Source : Calculated from Agricultural Statistics of Uttar Pradesh (Annual).

Appendix IV.4(ii) : Growth Rates of Foodgrain Yields :
M.P. (1969-85)

Sl. No.	Districts	Average Yield (Qtl./Ha.)		Index	Compound Growth Rate (Per cent Per Annum)
		1969-72	1982-85		
1.	Raipur	8.04	8.25	103	0.23
2.	Durg	5.55	6.71	121	1.48
3.	Rajnandgaon	5.73	6.03	105	0.38
4.	Bastar	6.36	6.77	106	0.45
5.	Bilaspur	7.21	6.85	95	-0.38
6.	Sarguja	6.01	6.25	104	0.30
7.	Raigarh	6.19	7.10	115	1.08
8.	Jabalpur	5.48	6.37	116	1.15
9.	Balaghat	8.83	8.29	94	-0.45
10.	Chindwara	5.73	8.80	154	3.38
11.	Seoni	5.97	5.78	97	-0.23
12.	Mandla	4.98	5.53	111	0.81
13.	Narsinghpur	6.78	8.66	128	1.92
14.	Sagar	6.37	7.31	115	1.08
15.	Damoh	6.26	6.85	109	0.67
16.	Panna	5.73	6.64	116	1.15
17.	Tikamgarh	7.06	11.42	162	3.78
18.	Chhattarpur	6.78	9.01	133	2.22
19.	Rewa	5.67	5.92	104	0.30
20.	Shindhi	5.02	5.20	104	0.30
21.	Satna	5.60	6.18	110	0.74
22.	Shahdol	5.02	5.12	102	0.15
23.	Indore	8.25	10.94	133	2.22
24.	Dhar	5.73	7.32	128	1.92
25.	Jhabua	4.68	5.32	114	1.01
26.	Khargone	5.27	6.71	127	1.86
27.	Khandwa	6.70	7.54	113	0.94
28.	Ujjain	7.41	8.44	114	1.01
29.	Mandsaur	6.44	9.30	144	2.84
30.	Ratlam	6.00	7.66	128	1.92
31.	Dewas	7.73	10.89	141	2.68
32.	Shajapur	8.30	10.14	122	1.54
33.	Morena	8.03	12.70	158	3.58
34.	Bhind	8.48	10.90	129	1.98
35.	Gwalior	7.44	12.37	166	3.98
36.	Shivpuri	5.80	9.33	161	3.73
37.	Guna	5.07	6.84	135	2.34
38.	Datia	5.73	9.80	171	4.21
39.	Bhopal	6.70	9.36	140	2.62
40.	Sehore	6.85	8.78	138	2.51
41.	Raisen	6.31	8.34	132	2.16
42.	Vidisha	6.22	8.38	135	2.34
43.	Betul	5.12	6.95	136	2.39
44.	Rajgarh	6.05	7.24	120	1.41
45.	Hushangabad	5.89	9.52	162	3.78
Madhya Pradesh		6.34	7.65	121	1.48

Source : Agricultural Statistics of M.P. (Annual).

Appendix V.5(i) : Average Yield of Major Crops in Uttar Pradesh (Average for 1983-86)

Sl. District No.	Average Yield Per Hectare				
	Rice (Kg.)	Wheat (Kg.)	Total Food- grains (Kg.)	Sugarcane (Qlts.)	
0	1	2	3	4	5
1. Agra	1185	2501	1643	375	
2. Aligarh	1255	2515	1734	450	
3. Bareilly	1682	1770	1555	408	
4. Bijnor	1823	1884	1768	504	
5. Budaun	1212	2043	1472	469	
6. Bulandshahr	954	2735	2224	461	
7. Etah	1062	2067	1507	402	
8. Etawah	1421	2344	1575	366	
9. Farrukhabad	1405	2433	1801	431	
10. Ghaziabad	1473	2672	2104	509	
11. Meerut	1706	2757	2395	512	
12. Mainpuri	1297	2138	1604	375	
13. Mathura	1194	2517	1811	323	
14. Moradabad	1705	2066	1733	476	
15. Muzaffarnagar	2239	2631	2353	582	
16. Pilibhit	2035	1935	1888	437	
17. Rampur	2137	2354	2024	449	
18. Saharanpur	2146	2771	2064	506	
19. Shahjahanpur	1735	2167	1751	472	
20. Barabanki	1447	1675	1411	420	
21. Fatehpur	1353	1908	1413	391	
22. Hardoi	1150	1869	1393	374	
23. Kanpur	1574	2453	1762	366	
24. Lakhimpur Kheri	1246	1699	1274	418	
25. Lucknow	1269	1670	1312	367	
26. Rae Bareilly	1406	1611	1369	396	
27. Sitapur	799	1503	1055	391	
28. Unnao	1041	1717	1309	382	
29. Allahabad	1261	1778	1406	368	
30. Azamgarh	1152	1920	1423	407	
31. Bahraich	898	1389	938	337	
32. Ballia	1025	1902	1272	361	
33. Basti	1037	1649	1212	427	
34. Deoria	1542	1975	1644	481	
35. Faizabad	1552	1485	1671	437	
36. Ghazipur	1176	1843	1419	358	
37. Gonda	1086	1658	1192	327	
38. Gorakhpur	1309	1777	1435	456	
39. Jaunpur	1342	1927	1565	411	
40. Mirzapur	1019	1238	1015	485	
41. Pratapgarh	1330	1714	1365	357	
42. Sultanpur	1437	1840	1513	383	
43. Varanasi	1463	1663	1451	362	

Contd.../-

Appendix IV.5(i) (Contd.)

0	1	2	3	4	5
44. Almora		877	865	955	-
45. Chamoli		1179	1015	1107	-
46. Dehra Dun		1338	1292	1341	605
47. Nainital		2478	2224	2206	487
48. Pithoragarh		1132	1101	1132	302
49. Pauri Garhwal		1003	901	968	404
50. Tehri Garhwal		1261	958	1068	-
51. Uttar Kashi		1603	1086	1259	-
52. Banda		874	1103	939	429
53. Hamirpur		804	1271	899	426
54. Jalaun		790	1549	1068	425
55. Jhansi		806	1519	1023	427
56. Lalitpur		565	1337	953	423
Uttar Pradesh		1353	1921	1464	471

Source : Calculated from Agricultural Statistics, U.P.,
(Annual).

Appendix IV.5(ii) : Average Yield of Major Crops in Madhya Pradesh (Average for 1982-85)

Sl. District No.	Average Yield Per Hectare			
	Rice (Kg.)	Wheat (Kg.)	Total Food- grains(Kg.)	Sugarcane (Qtls.)
1. Raipur	1054	771	825	35
2. Durg	1013	530	671	17
3. Rajnandgaon	866	541	603	19
4. Bastar	1008	605	677	27
5. Bilaspur	818	649	685	21
6. Sarguja	697	828	625	31
7. Raigarh	821	991	710	32
8. Jabalpur	500	870	637	20
9. Balaghat	976	585	829	47
10. Chindwara	865	1365	880	49
11. Seoni	927	565	578	31
12. Mandla	621	707	553	31
13. Narsinghpur	1082	1578	866	25
14. Sagar	634	855	731	24
15. Damoh	612	894	685	29
16. Panna	391	929	664	19
17. Tikamgarh	562	2136	1142	41
18. Chhatarpur	834	1252	901	24
19. Rewa	468	849	592	20
20. Shindhi	452	718	520	35
21. Satna	376	815	618	26
22. Shahdol	576	564	512	16
23. Indore	606	1782	1094	31
24. Dhar	558	1228	732	17
25. Jhabua	334	1199	532	31
26. Khargone	446	1581	671	26
27. Khandwa	851	1625	754	14
28. Ujjain	565	1205	844	22
29. Mandsaar	575	1882	930	15
30. Ratlam	434	1308	766	42
31. Dewas	559	1446	1089	19
32. Shajapur	608	1625	1014	21
33. Morena	1435	1838	1270	39
34. Bhind	1313	1575	1090	26
35. Gwalior	1177	1577	1237	34
36. Shivpuri	957	1391	933	26
37. Guna	672	752	684	21
38. Datia	573	1339	980	26
39. Bhopal	588	1097	936	26
40. Sehare	683	1014	878	33
41. Raisen	733	1014	834	33
42. Vidisha	503	877	834	18
43. Bitul	974	1069	695	39
44. Rajgarh	616	1026	724	32
45. Hushangabad	1091	1140	952	27
Uttar Pradesh	817	1107	765	34

Source : Calculated from Agricultural Statistics, M.P.,
(Annual).

CHAPTER V

Livestock Resources

V.1 Introduction

Along with human population livestock also puts pressure on the land and biotic resources, besides contributing valuable food and non-food products and providing draft power. Animal husbandry is an important component of the rural economy, next only to agriculture. In U.P. income from animal husbandry in 1981--82 was estimated at Rs.1903 crores, which was about 24 per cent of agricultural income and 13 per cent of the total income of the state. Comparable figures on these items are not available for M.P., but the importance of the animal husbandry is not likely to be any less there as compared to U.P.

V.2 Livestock Number and Density

According to Livestock Census, 1982 total number of livestock in U.P. was 567.35 lakhs and that in M.P. 427.45 lakhs, which comes to 13.6 per cent and 10.3 per cent of total livestock in the country. The composition of the livestock in the two states has been shown in Table V.1. Cattle and buffalo account for nearly three-fourths of total livestock in the two states, though the proportion of cattle is significantly larger in M.P. as compared to U.P., while that of buffaloes is more in U.P. In fact nearly 30 per cent of cattle and buffaloes of the country are found in the Central Zone. Goats are also found in large numbers in the Zone, though the number of sheep is relatively small.

Table V.1 : Composition of Livestock in Central Zone, 1982

Category	Uttar Pradesh		Madhya Pradesh	
	Number ('000)	Per cent	Number ('000)	Per cent
1. Cattle	26151	46.09	27117	63.44
(i) Male	19534	34.43	14068	32.91
(ii) Female				
(a) In Milk	3200	5.64	3716	8.69
(b) Total	6617	11.66	13049	30.53
2. Buffaloes	15785	27.83	6435	15.05
(i) Male	7879	13.89	2090	4.89
(ii) Female				
(a) In Milk	4593	8.10	1434	3.35
(b) Total	7906	13.93	4345	10.16
3. Total Cattle and Buffaloes	41936	73.92	33552	78.49
4. Sheep	2307	4.07	960	2.25
5. Goats	9686	17.07	7572	17.71
6. Horses and Ponies	212	0.37	112	0.26
7. Pigs	2281	4.02	474	1.11
8. Camels	40	0.07	16	0.04
9. Others	273	0.48	59	0.14
Total Livestock	56735	100.00	42745	100.00

Source : Livestock Census, 1982.

Though the number of livestock in the Central Zone is very large, it consists mostly of local non-descript type animals. The proportion of cross-bred cows was 8.9 per cent in U.P. in 1982 and less than 1 per cent in M.P. (Table V.2).

Table V.2 : Number of Livestock According to Breed in Central Zone, 1982

Category	Uttar Pradesh		Madhya Pradesh	
	Number	Per cent	Number	Per cent
1. <u>Buffaloes</u>				
(a) Cross Bred	2399	14.8	21	0.2
(b) Local	13850	85.2	14046	99.8
(c) Total	16249	100.0	14067	100.0
2. <u>Cows</u>				
(a) Cross Bred	875	8.9	45	0.3
(b) Local	8950	91.1	13005	99.7
(c) Total	9824	100.0	13050	100.0
3. <u>Sheep</u>				
(a) Cross Bred	178	7.7	3	1.0
(b) Local	2129	92.3	300	99.0
(c) Total	2307	100.0	303	100.0

Source : Livestock Census, 1982.

To examine the pressure of livestock population on land resources we have converted the livestock population of different categories and ages into livestock units based on standard animal feed as recommended by the Indian Council of Agricultural Research. For purposes of conversion adult cows, buffaloes, bullocks, horses, ponies have been taken as equivalent of 1 livestock unit, their youngstock between 1 - 3 years equivalent to 1/2 unit and youngstock below 1 year equivalent to 1/3 unit, 1 camel has been treated as equal to 2 units, 1.5 donkeys, 7 sheep, 6 pigs and 100 poultry equal to 1 unit.

Table V.3 : Density of Livestock in Central Zone, 1982

No. of Livestock Units	Uttar Pradesh	Madhya Pradesh
1. Per Hectare of Net Sown Area	2.0	1.7
2. Per Hectare of Area Under Fodder Crops	40.4	36.0
3. Per Hectare of Area Under Pastures and Grazing Land	115.0	12.0
4. Per Person of Human Population	0.5	0.8

The number of livestock unit per person comes to 0.5 in U.P. and 0.8 in M.P. as shown in Table V.3. Per hectare of net sown area livestock density comes to 2.0 in U.P. and 1.7 in M.P., while it is regarded that normally one hectare of cropped area cannot support more than 1 livestock unit in irrigated area and about 12 livestock unit in rainfed areas. As the table reveals there is an

excessive pressure of livestock population in relation to area under fodder crops as well as area under pastures and grazing land in both the states, though the availability of grazing land is relatively better in M.P.

District-wise indicators of livestock density have been shown in Appendix V.1(i) and V.1(ii). In U.P. livestock density per hectare of net sown area varies from 1.0 to 5.6, though majority of districts fall in the group having 1.5 to 2.5 livestock units per hectare of net sown area. In general the density is lower in the Bundelkhand region and higher in the Hill region. Livestock density is excessive in relation to area under fodder crops except in Western U.P., where mixed farming is more prevalent and area under fodder crops is relatively larger. The picture with respect to availability of pastures and grazing land is also dismal except in the Hill region.

In M.P. also livestock density per hectare of net sown area ranges from 1 to 8, though in most districts it is between 1 and 1.5. Density of livestock in relation to area under fodder crops shows extreme variation across districts. With respect to livestock density per hectare of area under pastures and grazing land the situation does not appear to be very adverse in majority of the districts in this state.

In relation to veterinary facilities also the number of livestock in the Central Zone is very large as can be seen from Table V.4.

**Table V.4 : Development of Veterinary Facilities
in Central Zone, 1986**

Veterinary Facility	U.P.	M.P.	India
A. <u>Actual Number of Veterinary Facility</u>			
(i) Veterinary Hospitals and Policlinics	1535	704	5113
(ii) Veterinary Dispensaries	216	1501	11361
(iii) Stockman Centres	2566	295	20157
2. <u>Number of Livestock (1982) Per Veterinary Facility in '000</u>			
(i) Veterinary Hospitals and Policlinics	37.0	60.7	82.0
(ii) Veterinary Dispensaries	262.7	28.5	36.9
(iii) Stockman Centre	22.1	144.9	20.9

V.3 Growth of Livestock

Table V.5(i) and V.5(ii) show the growth of livestock population by category during 1961-82 in U.P. and M.P. In U.P. the number of livestock declined marginally by 0.42 per cent between 1961 and 1972, but rose sharply by 15.3 per cent during the next decade. The livestock of various categories do not show a uniform trend. Thus, the number of cattle has been declining slowly but that of buffaloes has been sharply increasing. This mainly reflects the substitution of milch buffalo in place of low milk yielding cows. Sheep and goats reveal a sharp decline between 1961 and 1972 but a sharp rise thereafter. Pig population has also risen very sharply over time as also poultry population.

**Table V.5(i) : Growth of Livestock Population in
U.P. : 1961-2001**

(Numbers in '000)

Livestock	1961	1972	1982	Per cent Change 1961- 82	Annual Growth Rate During 1961-82	Project- ed Popula- tion in 2001
1. Total Cattle	26284	26217 (-0.3)	26151 (-0.3)	-0.50	-0.05	25697
2. Total Buffalo	10976	12592 (14.7)	15785 (25.4)	43.80	1.75	24315
3. Sheep	2462	1956 (-20.6)	2307 (17.9)	-6.30	0.31	3178
4. Goat	7958	6610 (-16.9)	9686 (46.6)	21.70	0.94	20038
5. Horses and Ponies	296	230 (-22.2)	212 (-8.0)	-28.40	-1.58	182
6. Mules	22	37 (65.1)	54 (46.7)	145.50	4.30	112
7. Donkeys	201	210 (4.5)	219 (3.9)	9.00	0.39	236
8. Camels	43	44 (2.5)	40 (-9.1)	-7.0	-0.34	33
9. Pigs	1161	1302 (12.1)	2281 (75.3)	96.5	3.27	6659
10. Total Livestock	49404	49199 (-0.4)	56735 (15.3)	14.8	0.66	73889
11. Poultry	3254	3920 (20.5)	6858 (75.0)	110.8	3.61	20020

Source : Livestock Census Reports

Note : Figures in brackets show per cent change over previous period.

**Table V.5(ii) : Growth of Livestock Population in
M.P. : 1961-2001**

(Numbers in '000)

Livestock	1961	1972	1982	Per cent Change 1961- 82	Annual Growth Rate During 1961-82	Proje- ted Popula- tion in 2001
1. Cattle	24774	26461 (6.8)	27117 (2.5)	9.46	0.43	28160
2. Buffaloes	5576	5795 (3.9)	6435 (11.0)	15.41	0.69	7921
3. Sheep	1009	1009 -	960 (-4.0)	-4.91	-0.23	873
4. Goats	5539	6267 (11.4)	7572 (22.8)	36.72	1.50	1124
5. Horses and Ponies	203	148 (-27.1)	112 (-24.2)	-44.71	1.79	74
6. Pigs	393	343 (-12.7)	474 (38.1)	20.47	0.89	877
7. Camels	16	14 (-10.8)	16 (12.7)	0.69	0.05	20
8. Other Livestock	58	52 (-9.8)	59 (13.7)	2.56	0.12	76
9. Total Livestock	37568	39989 (6.5)	42745 (6.9)	13.76	0.62	48802
10. Poultry	6525	6701 (2.7)	8383 (25.1)	28.47	1.20	12913

Source : Agricultural Statistics, Madhya Pradesh.

Note : Figures in brackets show per cent change over previous period.

In M.P. the pattern of growth in the two decades has been more steady as compared to U.P., the increase in total livestock being a little less than 7 per cent in the sixties as well as in the seventies. Both cattle and buffaloes show a rising trend in M.P., which is sharper in the later case. Sheep population in the State is steadily declining, but goat and pig population show a rapid increase as also poultry population.

Different statistical functions were fitted on quinquennial livestock Census during the period 1951 and 1982 for different categories of livestock. However, since the growth pattern has been quite erratic over time none of the functions showed a good fit. Therefore, we have made the simple assumption that livestock in different categories will increase between 1982 and 2001 at the rate of growth observed during the decade 1972 and 1982. Projected livestock population by categories is also shown in Table V.5(i) and V.5(ii).

V.4 Livestock Output

As the livestock in the Central Zone is generally of poor quality and remain under-nourished, the yield levels are extremely low. Thus, the average yield of milk per day in U.P. during 1988-89 is reported at 1.94 kg. per cow and 3.35 kg. per buffalo. For the same year the yield of eggs per hen was reported at 131 per year and that of wool at 0.817 kg. per sheep per year.

Firm estimates of total livestock product for the Central Zone are not available. The estimates of milk, egg and wool for

the two states of the Zone finalised by the Ministry of Agriculture have been given in Table V.6. Per capita output of milk is showing a rising trend and stood at 67 kg. and 52 kg. in U.P. and M.P. respectively during 1986-87. Thus in U.P. per capita availability of milk is more than the norm of 60 kg. recommended by the ICMR, while in M.P. it is only marginally less. The availability of eggs per capita is, however, extremely low 3 in U.P. and 13 in M.P.

Table V.6 : Estimated Output of Livestock Product in Central Zone

Items	Uttar Pradesh			Madhya Pradesh		
	1980-81	1986-87	% Increase	1980-81	1986-87	% Increase
A. Total Output						
(i) Milk ('000 Tonnes)	5665	8417	48.6	2210	3069	38.9
(ii) Egg (Million Nos.)	374	386	3.2	700	780	11.4
(iii) Wool (Lakh Kg.)	13.12	16.14*	3.0	7.90	8.70*	10.1
B. Per Capita Output						
(i) Milk (Kg.)	51	67	31.4	42	52.0	23.8
(ii) Egg (Nos.)	3.3	3.1	-6.1	13.4	13.1	-2.2
(iii) Wool (Kg.)	0.012	0.013	8.3	0.015	0.015	-

* Data is for 1984-85.

Source : Ministry of Agriculture, Government of India, Report of the Technical Committee of Direction for Improvement of Animal Husbandry and Dairying Statistics, New Delhi, 1988.

On the basis of the number of animals slaughtered the Department of Animal Husbandry, Government of U.P., estimated total output of meat in the state at 352 lakh kg. in 1977-78, which comes to only 0.35 kg per capita per year. Even if we account for the animals slaughtered unofficially per capita meat availability would not be more than 0.5 kg. Applying the same rate of slaughter of animals and per animal meat output, total output of meat in M.P. can be put at 178 lakh kg. or 0.37 kg. per capita. These figures appear to be on the lower side.

Fish output according to official sources amounted to 83100 tonnes in U.P. (1977-78) and 26464 tonnes in M.P. (1985-86). In per capita terms the output comes to only 0.66 kg. in U.P. and 0.45 kg. in M.P. Moreover, much of the fish output from the two states is exported to outside states particularly West Bengal.

The elasticity of demand for milk as well as meat, eggs and fish generally exceeds 1 in the two states (Table III.2). It would, therefore, be reasonable to assume that the demand for milk will increase at the rate of around 6 per cent and that of 'meat, egg and fish' at around 4 per cent per annum.

V.5 Fodder Requirement and Availability

Inadequacy of fodder for livestock has been a major constraint on the development of livestock resources in the country. As a result the animals are left free for grazing, thus causing considerable damage to crops and environment. Several estimates of fodder requirement and availability have been

attempted in the past. According to Vaidyanathan's estimates the availability of digestible nutrients comes to 200 kg. per livestock in U.P. and 180 kg. per livestock in M.P., while availability of digestible crude protein was only 10 kg. and 6 kg. per livestock in the two states respectively (Table V.7). Thus, the availability of nutrients for livestock has been far below the requirement, though green revolution has marginally improved the situation.

Table V.7 : Estimated Nutrient Availability for Livestock in Central Zone : 1951-1972

('000 tonnes)

Item	1951	1961	1972
A. Uttar Pradesh			
(i) Total Digestible Nutrient	7308 (170)	8544 (170)	11074 (200)
(ii) Total Digestible Crude Protein	267 (10)	430 (10)	479 (10)
B. Madhya Pradesh			
(i) Total Digestible Nutrient	3458 (NA)	5372 (140)	7085 (180)
(ii) Total Digestible Crude Protein	114 (NA)	154 (4)	225 (6)

Source : A. Vaidyanathan, Bovine Economy in India, Oxford & IBH Publishing Co., New Delhi, 1983, Appendix V.

Note : Figures in brackets show availability of nutrients per livestock in Kg. per year.

We have prepared our own estimates of requirement and availability of livestock in the Central Zone for the year 1981-82 broadly following the methodology of the National Commission on Agriculture 1976. Requirement of livestock feed has been calculated by multiplying the number of livestock by the required norm for different type and ages of livestock recommended by the National Commission on Agriculture reproduced in Table V.8.

Availability of dry fodder has been computed by multiplying the output of different crops by average ratio of fodder to grain adopted by the National Commission on Agriculture - 1.20 for paddy and wheat, 1.97 for coarse cereals, 0.51 for pulses and 0.50 for groundnuts. Production of green fodder has been calculated assuming a yield of 50 tonnes per hectare of irrigated area and 25 tonnes per hectare of unirrigated area under fodder cultivation. Concentrates consist of oil cakes, bran, coarse grains, cotton seeds, etc. For finding the availability of concentrates it is assumed that 2 per cent of the total production of coarse grains, 80 per cent of output of edible oil cakes, 90 per cent output of cotton seeds, 96 per cent of output of rice and wheat bran and 12 per cent of pulse byproduct are fed to livestock as assumed by the National Commission on Agriculture. The output of these items was estimated by applying standard conversion rates to the reported output.

Table V.9 shows the availability and requirement of feeds and fodder in the Central Zone. The table brings into sharp focus the enormous gap between requirement and availability in the Central

**Table V.8 : Recommended Nutrition Requirement Per Head
by Livestock Category**

Category of Livestock	Requirement Per day in Kg. per Head		
	Concentra- tes	Green Fodder	Dry Fodder
1. Cattle			
(a) Males Working and Breeding	0.25	5.00	5.50
(b) Females Milch and Dry non-Descript	0.20	5.00	4.00
Improved Indigenous Crossbred	1.20	10.00	6.00
(c) Youngstock Crossbred	1.50	10.00	2.00
Others	0.50	5.00	1.50
2. Buffaloes			
(a) Males Working and Breeding	0.20	5.00	5.00
(b) Females Milch and Dry Non-Descript	0.50	5.00	5.00
Improved Indigenous	1.50	10.00	6.00
(c) Youngstock	0.10	5.00	2.00
3. Improved Poultry	-	-	-
4. Improved Sheep	0.30	-	0.40
5. Improved Goats	0.30	-	0.40
6. Improved Pigs	1.50	1.00	-
7. Horses and Ponies	0.50	-	-
8. Camels	0.50	-	-

Source : Government of India, Report of National Commission on Agricultural, 1976, Part VIII, Animal Husbandry, p.433.

**Table V.9 : Availability and Requirement of Feeds and Fodder
in Central Zone, 1981-82**

(Lakh Tonnes)

Items	Availability	Requirement	Deficit	
			Actual	Per cent
A. <u>Uttar Pradesh</u>				
1. Dry Fodder	341.43	500.72	159.29	-31.8
2. Green Fodder	93.52	728.17	634.65	-87.0
3. Concentrates	17.70	80.15	62.45	-73.0
B. <u>Madhya Pradesh</u>				
1. Dry Fodder	146.60	482.19	335.59	-69.6
2. Green Fodder	242.31	747.45	505.14	-67.6
3. Concentrates	10.42	80.62	70.20	-87.1

Zone. The availability is hardly 20-25 per cent of requirement in most of the cases.

V.6 Projected Fodder Requirement

The projected requirement of fodder would depend upon the expected growth of livestock, changes in its composition and average feed requirement per animal. As already mentioned population of different categories of livestock has been projected to increase between 1982 and 2001 at the observed rate of increase during 1971 and 1982, as no good statistical fit could be obtained for the long period data. Age structure of livestock has been

assumed to be the same as in 1982. The proportion of crossbred and local breeds has been taken from the projections of the National Commission on Agriculture. Finally, the requirement of fodder has been calculated by multiplying the number of livestock in cash category by feed per animal recommended by the National Commission on Agriculture. The projected requirement of concentrates, green fodder and dry fodder in U.P. and M.P. in the year 2001 have been shown in Table V.10. The projections reveal that the requirement of animal feed and fodder is likely to go up substantially, if the rate of increase in livestock continues unabated.

Table V.10 : Projected Requirement of Feeds and Fodder in Central Zone in 2001

(in Lakh Tonnes)

Category of Livestock	Uttar Pradesh			Madhya Pradesh		
	Concen- trates	Green Fodder	Dry Fodder	Concen- trates	Green Fodder	Dry Fodder
1. Cattle	64.20	678.20	436.50	84.60	815.00	443.20
2. Bovine	11.80	445.20	291.90	14.10	165.80	109.10
3. Poultry	0.003	-	-	0.001	-	-
4. Sheep	2.60	-	3.50	1.10	-	1.50
5. Goats	-	-	-	-	-	-
6. Pigs	14.10	9.40	-	5.50	0.37	-
7. Horses	7.70	-	-	1.80	-	-
8. Camels	0.05	-	-	0.02	-	-
Total	100.45	1132.80	731.90	107.12	981.17	553.80
Per cent In- crease Over Requirement in 1981-82	25.30	55.60	46.70	32.90	31.30	14.9

The increase in dry fodder requirement as estimated by us is of a lower order than that of the National Commission on Agriculture, which estimated that requirement of dry fodder would go up by 7.4 per cent between 1973 and 2000. The Committee on Fodder and Grasses has however postulated even higher level of requirement - an increase of 21.8 per cent between 1985-2000. The differences were both on account of higher growth rate of livestock as well as higher feed rate envisaged by the latter. We have also derived fodder requirement for U.P. and M.P. in 2000 from the projected national level requirements by the two sources in proportion to the ratio of the two states in standard livestock units in 1982, i.e. 15.8 per cent and 11.5 per cent respectively. The three estimates have been given in Table V.11. It will be seen that our estimates are higher than those derived from National Commission on Agriculture but considerably lower than those derived from the Committee on Fodder and Grasses.

Table V.11 : Alternative Estimates of Fodder Requirement in Central Zone in 2000
(in Lakh Tonnes)

Estimates	Green Fodder		Dry Fodder	
	U.P.	M.P.	U.P.	M.P.
1. Our Estimate	1133	981	732	554
2. Derived from National Commission on Agriculture	932	679	589	429
3. Derived from Report of the Committee on Fodder and Grasses	1795	1306	1500	1091

V.7 Grazing Land Availability

Only 3.19 lakh hectare of land in U.P. (1 per cent of reported area) is classified under permanent pastures and grazing land. Availability of grazing land is relatively larger in M.P. - 28.10 lakh hectare or 6.4 per cent of reported area. Total area used for grazing which includes area under forests, pastures and grazing land, culturable wasteland, other fallows and area under miscellaneous tree crops and groves - comes to 79.21 lakh hectare in U.P. and 196.66 lakh hectare in M.P. (Table V.12). However, in relation to the livestock numbers this area is quite inadequate. The intensity of grazing comes to 4.35 livestock units in U.P. and 1.62 livestock units in M.P. Against this it is estimated that only half-livestock unit can be maintained on 1 hectare of grazing land. It is thus evident that there is an intense pressure on grazing lands in the Central Zone, particularly in U.P.

It is estimated that 4.1 per cent of livestock in U.P. and 19.9 per cent in M.P. graze in the forest lands giving a grazing intensity of 44 cow units in U.P. and 65 cow units in M.P. per 100 hectare of open forest areas.¹ In some of the hill districts of U.P. the grazing incidence goes upto 7 to 8 hundred cattle units per 100 hectare.² The high extent of overgrazing in the forests is an important factor contributing to degradation of forests.

1. National Wastelands Development Board, Report of the Committee on Fodder and Grasses, p.31.

2. Ibid., p.32.

**Table V.12 : Area Under Major Categories of Land Providing
Grazing in Central Zone : Early 1980's**

Land Use Category	Area in Lakh Hectares	
	Uttar Pradesh	Madhya Pradesh
1. Forests	51.25	140.27
2. Permanent Pastures and Grazing Land	3.19	28.10
3. Culturable Wastelands	11.26	17.78
4. Fallow Land other than Current Fallow	7.84	8.95
5. Area under Miscellaneous Tree Crops and Grasses	5.67	1.56
6. Total Area Under 1 - 5	79.21	196.66
7. Number of Livestock Units (Lakhs)	344.44	318.59
8. Livestock Units Per Hectare of Grazing Area	4.35	1.62

Another problem related to grazing is that of migratory grazing particularly from Rajasthan, which is faced by bordering districts of U.P. and M.P. In U.P. Himalayas as well as in some parts of Vindhyan ranges livestock migration from lower reaches to higher reaches in the summers takes place.

V.8 Strategy of Livestock and Fodder Development

Development of animal husbandry needs maximum encouragement to supplement income as well as to generate additional employment. The demand for various livestock products is expected to rise rapidly with rising incomes. Central Zone offers great potential

for development of animal husbandry. However, the present number of livestock is excessive and its productivity is extremely low as it is underfed and undernourished. In fact present availability of fodder is not sufficient even to maintain one-fourth of the present livestock at adequate level of nutrition.

The strategy of livestock development should, therefore, aim at reduction in its number and improvement in the quality of the livestock through cross breeding. An important problem to be encountered in this respect is the need of draft animal power particularly on small holdings. Establishment of an extensive net work of tractor stations for hiring out would be an important step in this direction. Secondly, the infrastructure of veterinary services, which is very inadequate, has to be expanded and streamlined.

The success of livestock development programme cannot be ensured without arrangement of adequate quantity of good quality feed and fodder. The National Commission on Agriculture and the Committee on Fodder and Grasses have given very useful and detailed suggestions in this respect, which need urgent consideration and action. In particular we would like to mention the following suggestions for increasing the supply of feed and fodder.

1. At present very small area is being devoted to cultivation of fodder crops. Farmers have to be encouraged to take up cultivation of green fodder crops on a commercial basis and should be provided with good quality seed and other inputs.

2. The wastage of fodder through wrong feeding practices and improper storage, etc. should be minimised.

3. Since there is a large seasonal and regional variation in the supply of fodder arrangement have to be made for collection, storage and transport of properly prepared fodder.

4. The existing pastures and grazing lands have to be effectively preserved and developed to yield their full biological potential through control of free grazing, cultivation of more nutritious and high yielding grasses, supply of good quality grass seed, etc.

5. Culturable wastelands estimated to be about 14 lakh hectare in U.P. and 18 lakh hectare in M.P. should be utilised for purposes of fodder production through silvi-pastoral techniques, rather than for crop cultivation. These wastelands should be distributed to cooperatives of landless labourers, who should be provided with necessary facilities for growing fodder trees, grasses and crops.

6. To overcome the problem of overgrazing the practice of uncontrolled grazing particularly in the forest areas has to be checked. Farmers should be encouraged and educated to take up stall feeding.

Needless to say such programme of development of livestock and fodder supply on the above lines cannot succeed without full involvement and cooperation of the villagers. The voluntary agencies can play a vital role in this area.

Appendix V.1(i)

District-wise Livestock Density in Uttar Pradesh, 1982

District	Total Live- stock Units ('000)	Livestock Units Per Hectare of			Ratio of Fodder Crops to Total Cropped Area
		Net Area Sown	Area Under Fodder Crops	Area Under Pastures & Grazing Land	
0	1	2	3	4	5
1. Agra	552	1.6	23	377	4.74
2. Aligarh	784	2.0	22	273	4.97
3. Bareilly	563	1.7	29	1271	4.19
4. Bijnor	580	1.7	13	823	10.55
5. Budaun	649	1.6	94	923	1.29
6. Bulandshahr	739	2.2	12	430	10.66
7. Etah	563	1.9	74	482	1.73
8. Etawah	531	1.8	79	231	1.69
9. Farrukhabad	518	1.8	131	162	1.09
10. Ghaziabad	516	2.7	10	1025	17.55
11. Meerut	739	2.4	8	1381	19.23
12. Mainpuri	547	1.9	79	185	1.82
13. Mathura	499	1.6	13	289	9.08
14. Moradabad	843	1.7	15	776	8.91
15. Muzaffarnagar	737	2.2	8	922	18.51
16. Pilibhit	313	1.4	23	1474	3.86
17. Rampur	294	1.6	19	13378	6.32
18. Saharanpur	814	2.1	8	1609	16.46
19. Shahjahanpur	530	1.5	30	414	3.37
20. Barabanki	555	1.9	53	254	2.22
21. Fatehpur	578	2.0	82	170	1.77
22. Hardoi	737	1.8	127	131	1.19
23. Kanpur	755	1.8	87	170	1.72
24. Lakhimpur- Kheri	649	1.4	51	453	2.16
25. Lucknow	387	2.6	102	118	1.77
26. Rae Bareli	784	2.8	208	187	0.95
27. Sitapur	783	1.8	89	1070	1.56
28. Unnao	692	2.6	193	204	1.01
29. Allahabad	1141	2.4	206	937	0.91
30. Azamgarh	837	2.0	122	499	1.12
31. Bahraich	1074	2.4	277	1068	0.50
32. Ballia	468	2.0	430	4003	0.39
33. Basti	931	1.7	112	443	0.99
34. Deoria	718	1.6	457	1994	0.33

Contd.../-

Appendix V.1(i) (Contd.)

0	1	2	3	4	5
35. Faizabad	669	2.3	67	329	2.02
36. Ghazipur	718	2.8	80	612	2.71
37. Gonda	1051	2.1	204	598	0.65
38. Gorakhpur	918	1.9	330	2469	0.38
39. Jaunpur	631	2.2	229	412	0.71
40. Mirzapur	1028	2.8	472	517	0.50
41. Pratapgarh	688	3.0	240	872	0.94
42. Sultanpur	686	2.4	66	365	2.44
43. Varanasi	757	2.4	116	2979	1.61
44. Almora	434	3.9	5943	9	-
45. Chamoli	270	5.6	-	10	-
46. Dehradun	188	3.3	70	37603	3.21
47. Nainital	363	1.8	25	293	4.33
48. Pithoragarh	348	4.5	49690	5	-
49. Pauri Garhwal	390	3.8	13941	12	0.03
50. Tehri Garhwal	209	3.0	-	14	-
51. Uttar Kashi	136	4.1	-	7	-
52. Banda	816	1.7	564	4774	0.32
53. Hamirpur	572	1.1	2007	747	0.03
54. Jalaun	338	1.0	155	1520	0.69
55. Jhansi	416	1.4	955	446	0.10
56. Lalitpur	416	2.1	1108	52	0.15
Uttar Pradesh	34444	2.0	40	115	3.62

Source : (i) Livestock Census, 1982.

(ii) Bulletin of Agricultural Statistics.

Appendix V.1(ii)

District-wise Livestock Density in Madhya Pradesh, 1982

District	Total Live- stock Units ('000)	Livestock Units Per Hectare of			Ratio of Fodder Crops to Total Cropped Area
		Net Area Sown	Area Under Fodder Crops	Area Under Pastures & Grazing Land	
0	1	2	3	4	5
1. Raipur	1506	1.6	5792	12	0.02
2. Durg	758	1.4	6318	10	0.02
3. Rajnandgaon	688	1.4	13768	10	0.01
4. Bastar	1191	1.5	29791	8	0.01
5. Bilaspur	1384	1.7	10643	11	0.01
6. Sarguja	1130	2.0	113018	7	0.001
7. Raigarh	803	1.5	16057	8	0.01
8. Jabalpur	744	1.7	564	7	0.23
9. Balaghat	512	1.9	3010	15	0.05
10. Chindwara	734	1.5	1183	13	0.11
11. Seoni	497	1.3	179	14	0.67
12. Mandla	639	1.5	15968	16	0.01
13. Narsinghpur	396	1.4	94	13	1.37
14. Sagar	719	1.4	14	6	9.40
15. Damoh	471	1.7	48	8	3.26
16. Panna	500	2.4	1064	38	0.20
17. Tikamgarh	553	2.4	15	9	11.72
18. Chhatarpur	775	2.3	19	9	10.48
19. Rewa	723	2.0	1419	17	0.12
20. Shidhi	809	2.5	20217	-	0.01
21. Satna	701	2.0	17512	30	0.01
22. Shahdol	1640	3.8	-	26	-
23. Indore	278	1.1	9	8	9.09
24. Dhar	566	1.1	15	10	6.44
25. Jhabua	2746	8.0	178	57	4.01
26. Khargone	838	1.3	83	8	1.48
27. Khandwa	506	1.2	77	7	1.37
28. Ujjain	457	1.0	9	6	9.28
29. Mandsaur	710	1.6	9	12	10.61
30. Ratlam	359	1.2	8	9	11.68
31. Dewas	445	1.3	10	5	10.99
32. Shahajpur	513	1.2	10	8	10.91
33. Morena	811	2.1	118	12	1.60
34. Bhind	457	1.4	84	18	1.56

Contd.../-

Appendix V.1(ii) (Contd.)

0	1	2	3	4	5
35. Gwalior	429	1.7	50	17	3.07
36. Shivpuri	764	2.1	13	12	14.39
37. Guna	730	1.3	12	11	9.63
38. Datia	169	1.3	77	24	1.58
39. Bhopal	167	1.0	10	5	9.72
40. Sehore	523	1.5	10	10	12.80
41. Raisen	426	1.0	18	13	5.34
42. Vidisha	479	0.9	17	12	5.21
43. Betul	560	1.4	75	26	1.59
44. Rajgarh	527	1.3	9	6	13.40
45. Hushangabad	503	1.1	19	9	4.71
Madhya Pradesh	31859	1.7	36	12	3.93

Source : (i) Livestock Census, 1982.

(ii) Bulletin of Agricultural Statistics, M.P.

looked at the land use pattern at the district level. For the 8 districts of U.P. Hills conventional data was being reported till 1974-75, but since then survey data is being compiled.

The details of the nine-fold land use classification and the definitions adopted are given below :

(i) Forests

Area under forests include all lands classified as forest under any legal enactment dealing with forest or administered as forests, whether State owned or private and whether wooded or maintained as potential forest land. The area under a crop raised or open for grazing within the forest should remain included under the forest area.

(ii) Barren and Unculturable Land

This category consists of all barren and unculturable land like mountains, deserts, etc. Land which cannot be brought under cultivation unless at a high cost shall be classed as unculturable, whether such land is in isolated blocks or within cultivated holdings.

(iii) Land Put to Non-Agricultural Uses

This includes lands occupied by the buildings, roads, railways, grave-yards, cremation grounds or under water e.g. rivers and Canals and other land put to uses other than agricultural use.

(iv) Culturable Waste

This includes lands available for cultivation whether or not taken up for cultivation once but not cultivated during the current year and last five years or more in succession. Such lands may be either fallow or covered with shrubs and jungles which are not put to any use. They may be assessed or unassessed and may be in isolated blocks or within cultivated holdings. Land once cultivated but not cultivated for five years in succession shall also be included in this category at the end of the five years.

(v) Permanent Pastures and Other Grazing Lands

These cover all grazing lands, whether or not they are permanent pastures and meadow village common grazing land are also included under this need.

(vi) Land Under Miscellaneous Tree Crops and Groves not Included in Net Area Sown

This category includes all culturable lands which is not included under net area sown but is put to some agricultural use. Land under casurina trees, thatching grass, bamboo bushes and other groves for fuel etc. shall be classed under this category.

(vii) Current Fallows

Current fallows are the lands which are left fallow during the current year only.

(viii) Other Fallows

These include all the lands which were taken up for cultivation but are temporarily out of cultivation for a period of not less than one year and not more than five years. The reason for keeping such lands fallow may be poverty of the cultivators, inadequate supply of water, malarial climate, silting of canals and rivers and unremunerative nature of farming etc.

(ix) Net Area Sown

This represents net area sown under crops, the areas sown more than once during the year being counted once only.

VI.2 State Level Trends : Uttar Pradesh

Table VI.1 shows the details of land use pattern in Uttar Pradesh. The total reported area for U.P. is 297.6 lakh hectare out of which 51.3 lakh hectare (17.2 per cent) is under forests, 23.6 lakh hectare (7.9 per cent) is under non-agricultural uses, while 11.1 lakh hectare (3.7 per cent) is classified as barren and uncultivable land and 3.2 lakh hectare (1.1 per cent) is under permanent pastures and grazing land. The remaining 208.7 lakh hectare (70 per cent) may be regarded as cultivable land, out of which 172.6 lakh hectare (58 per cent of total area and 83 per cent of cultivable area) is under crop cultivation and 5.7 lakh hectare (1.9 per cent) is under miscellaneous tree crops and

Table VI.1

Trends in Land Use Pattern in Uttar Pradesh : 1956-57
to 1985-86

(Unit - Lakh Hectares)

Land Use Category	Average Area Under the Category During					
	1956-57	1961-62	1966-67	1971-72	1976-77	1980-81
	to 1960-61	to 1965-66	to 1970-71	to 1975-76	to 1980-81	to 1985-86
1. Reporting Area for Land Utilisation	298.10 (100.0)	293.82 (100.0)	297.31 (100.0)	298.47 (100.0)	297.75 (100.0)	297.98 (100.0)
2. Forests	40.70 (13.65)	37.12 (12.63)	45.32 (15.24)	50.90 (17.05)	51.09 (17.16)	51.25 (17.21)
3. Land Put to Non-Agricultural Uses	18.86 (6.33)	19.57 (6.66)	20.19 (6.79)	20.98 (7.03)	22.17 (7.45)	23.55 (7.91)
4. Barren and Uncultivable Land	25.74 (6.33)	25.45 (8.66)	19.56 (6.58)	12.98 (4.35)	11.59 (3.89)	11.12 (3.73)
5. Permanent Pastures and Other Grazing Lands	0.35 (0.12)	0.54 (0.18)	0.76 (0.26)	1.98 (0.66)	2.89 (0.97)	3.19 (1.07)
6. Land Under Miscellaneous Tree Crops and Groves	10.21 (3.42)	8.33 (2.84)	9.87 (3.32)	9.77 (3.27)	7.10 (2.38)	5.67 (1.90)
7. Culturable Waste Lands	17.02 (5.71)	15.53 (5.28)	13.95 (4.69)	14.43 (4.83)	12.94 (4.35)	11.26 (3.78)
8. Current Fallows	1.69 (0.57)	4.33 (1.47)	8.57 (2.88)	9.40 (3.15)	10.63 (3.57)	11.33 (3.80)
9. Old Fallows	13.25 (4.44)	9.89 (3.37)	5.56 (1.87)	5.92 (1.98)	6.35 (2.13)	7.84 (2.63)
10. Net Area Sown	170.27 (57.13)	173.04 (58.91)	173.52 (58.37)	172.08 (57.65)	172.99 (58.10)	172.55 (57.95)

Source : Bulletin of Agricultural Statistics, U.P. (Annual).

Note : Figures in parenthesis show percentage to total area.

groves, while 19.2 lakh hectare (10.5 per cent) is classified as fallow land and 11.3 lakh hectare (3.8 per cent) as culturable waste.

The land use pattern in Uttar Pradesh reveals severe imbalances and deficiencies. Only around one-sixth of the land area is under forests, whereas according to the National Forest Policy at least one-third of the area should be under forests for ecological balance. Area under pastures and grazing land, which is hardly 1 per cent of total area, is highly inadequate for the large livestock in the state, which are consequently left for free grazing causing soil erosion and damage to crops and vegetation. The extensive margin of cultivation has reached a near saturation point and even marginal and sub-marginal lands have been brought under cultivation. Even then per capita sown area is extremely low, hardly 0.16 hectare. About 19 lakh hectare area (10.5 per cent of geographical area and 11.1 per cent of net sown area) under current or old fallows is not put to any productive use due to problems like lack irrigation, waterlogging, salinity, etc. In addition about 11 lakh hectare are under the category of culturable and non-culturable waste each. Thus nearly one-fifth of the land in the state is not put to productive use, while about one-tenth is under essential non-agricultural uses. The productivity of the remaining two-thirds of the land, whether under forests or cultivation, is generally low and large areas are suffering from land degradation of various degrees.

Table VI.2

**Period-wise Shifts in Area Under Different Land Use Categories
in U.P. : 1956-57 to 1985-86**

(Unit - Lack Hectares)

Particulars	B E T W E E N							
	1956-61	1961-66	1966-71	1971-76	1976-81	1956-61	1966-71	
	and 1961-66	and 1966-71	and 1971-76	and 1976-81	and 1981-86	and 1981-86	and 1981-86	
1. Reporting Area for Land Utilisation	- 4.28 (-1.44)	3.49 (1.19)	1.16 (0.39)	- 0.72 (-0.24)	0.03 (0.01)	- 0.32 (-0.11)	0.47 (0.16)	
2. Forests	- 3.58 (-8.79)	8.20 (22.09)	5.58 (12.31)	0.19 (0.37)	0.16 (0.31)	10.55 (25.92)	5.93 (13.08)	
3. Land Put to Non-Agriculture Uses	0.71 (3.76)	0.62 (3.17)	0.79 (3.91)	1.19 (5.67)	1.38 (6.22)	4.69 (24.87)	3.36 (16.64)	
4. Barren and Uncultivable Land	- 0.29 (-1.13)	-5.89 (-23.14)	-6.58 (-33.64)	- 1.39 (-10.71)	-0.47 (-4.05)	-14.62 (-56.80)	-8.44 (-43.15)	
5. Permanent Pastures & Other Grazing Lands	0.19 (54.28)	0.22 (40.74)	1.22 (160.53)	0.91 (45.96)	0.30 (10.38)	2.84 (811.43)	2.43 (319.74)	
6. Land Under Miscellaneous Trees, Crops and Groves	- 1.88 (-18.41)	1.54 (18.49)	-0.10 (-1.01)	- 2.67 (-27.33)	-1.43 (-20.14)	- 4.54 (-44.46)	-4.20 (-42.55)	
7. Culturable Waste Lands	- 1.49 (-8.75)	-1.58 (-10.17)	0.48 (3.44)	- 1.49 (-10.34)	-1.68 (-12.98)	- 5.76 (-33.84)	-2.69 (-19.28)	
8. Current Fallows	2.64 (156.21)	4.24 (97.92)	0.83 (9.68)	1.23 (13.08)	0.70 (6.58)	9.64 (570.41)	2.76 (32.20)	
9. Old Fallows	- 3.36 (-25.36)	-4.33 (-43.78)	0.36 (6.47)	0.43 (7.26)	1.49 (23.46)	- 5.41 (-40.83)	2.28 (41.01)	
10. Net Area Sown	2.77 (1.63)	0.48 (0.28)	-1.44 (-0.83)	0.91 (0.53)	-0.44 (-0.25)	2.88 (1.34)	-0.97 (-0.56)	

Source : Bulletin of Agricultural Statistics, U.P. (Annual).

Note : Figures in parenthesis show per cent change.

Table VI.2 shows the shifts in area under different land use categories over the period 1955-85 as well as at quinquennial intervals. Forest area shows a rise of 10.6 lakh hectare or 25.9 per cent over the entire period. The increase has taken place basically during the period between 1961-66 and 1971-76. Since mid-seventies there is practically no change in area under forests. As a result of expansion of infrastructure, industrialisation and urbanisation and area under non-agricultural uses has steadily increased. Over the entire period area under this category has gone up by 4.69 lakh hectare or nearly 25 per cent. Area under barren and uncultivable land has declined significantly over the period. Area under pastures and grazing land shows a significant increase, but that under miscellaneous trees and groves shows a decline. Area under cultivable wasteland shows a decline of about 5.8 lakh hectare or 34 per cent. Area under current fallows shows a rapid and continuous increase. Area under old fallows after showing a sharp decline upto 1970-71 has also been increasing in recent years. Net sown area registered a modest increase in the initial period, but has stabilised since the mid-sixties, indicating that limit of extensive cultivation has been reached in the State.

The differential trends in land use categories have resulted in clear shifts in proportion of area under different categories over the period (Table VI.1). The land use categories which have gained clearly are : forests, land

put to non-agriculture uses, pastures and grazing land and current fallows. The other categories show a sharp decline in their share in total area. The share of net sown area has been more or less static over the period. The increase in area under fallow land should be a matter of concern for planners.

Trends in land use were further examined by fitting log linear regression on area under each land use category for the period 1968-69 to 1985-86. The following form of equation was used to calculate the growth rate :

$$\text{Log } y = \log A + X \log B$$

where Y is the area under a specific land use category and X is time. The compound annual growth rate is given by $\text{Antilog } B - 1/100$. This implies a constant rate of change over time. The computed regression estimates and rates of growth for U.P. have been given in Table VI.3. The T values indicate that all estimated B co-efficients were significant except in the case of area under forests and net sown area. The goodness of the fit was also found to be high.

VI.3 State Level Trends : Madhya Pradesh.

Details of land use pattern in M.P. are given in Table VI.4. Total reported area of M.P. is 442 lakh hectare out of which 140 lakh hectare (31.7 per cent) is under forests, 22.5 lakh hectare (5.1 per cent) are put to non-agricultural uses while 23.4 lakh hectare (5.3 per cent) are classified as

Table VI.3

Log Linear Regression Estimates on Area Under Major Land
Use Categories in U.P. : 1968-69 to 1985-86

Land Use Categories	Constant	Beta	T Value	R ²	F-Value	Average Compound Growth Rate (%)
1. Forests	10.76	-0.0068	0.1	0.0002	0.004	-0.01
2. Barren and Unculturable Land	9.788	-0.1763 [*]	14.1	0.92	198.0	-0.18
3. Land Put to Non-Agricultural Uses	9.612	0.2513 ^{**}	1.5	0.13	2.3	0.25
4. Culturable Waste	9.637	-0.0839 ^{**}	2.8	0.34	8.1	-0.08
5. Permanent Pastures & Other Grazing Lands	6.244	-0.6624 [*]	7.3	0.77	53.1	0.68
6. Land Under Miscellaneous Tree Crops and Groves	9.521	-0.2802 [*]	4.5	0.56	20.4	-0.28
7. Current Fallows	8.917	0.1443 [*]	4.7	0.58	22.3	0.14
8. Other Fallows	8.517	0.1278 [*]	4.3	0.53	18.3	0.13
9. Net Area Sown	12.06	-0.0025 [*]	1.3	0.06	1.6	0.002

* Significant at 1 per cent level.

** Significant at 5 per cent level.

Table VI.4

**Trends in Land Use Pattern in Madhya Pradesh : 1956-57
to 1985-86**

(Unit - Lakh Hectares)

Land Use Category	Average Area Under the Category During					
	1956-57 to 1960-61	1961-62 to 1965-66	1966-67 to 1970-71	1971-72 to 1975-76	1976-77 to 1980-81	1981-82 to 1985-86
1. Total Geographical Area	437.81 (100.0)	440.41 (100.0)	442.75 (100.0)	443.04 (100.0)	442.47 (100.0)	442.11 (100.0)
2. Forests	137.86 (31.49)	143.42 (32.56)	145.81 (32.93)	143.93 (32.49)	141.97 (32.09)	140.27 (31.72)
3. Land Put to Non-Agriculture Uses	19.05 (4.35)	20.54 (4.66)	20.68 (4.67)	20.97 (4.73)	21.95 (4.96)	22.51 (5.08)
4. Barren and Uncultivable Land	24.76 (5.66)	22.15 (5.03)	22.81 (5.15)	23.00 (5.19)	23.12 (5.23)	23.38 (5.29)
5. Permanent Pastures & Other Grazing Lands	34.81 (7.96)	41.22 (9.36)	33.13 (7.48)	31.36 (7.08)	28.80 (6.51)	28.10 (6.36)
6. Land Under Miscellaneous Tree Crops and Groves	3.46 (0.79)	3.12 (0.71)	1.22 (0.28)	1.40 (0.32)	1.46 (0.33)	1.56 (0.35)
7. Culturable Waste Lands	36.31 (8.30)	25.49 (5.78)	22.58 (5.09)	20.48 (4.62)	19.28 (4.36)	17.78 (4.02)
8. Current Fallows	8.60 (1.96)	7.92 (1.81)	7.67 (1.73)	7.75 (1.75)	9.42 (2.13)	8.45 (1.90)
9. Old Fallows	15.56 (3.56)	11.68 (2.65)	9.50 (2.15)	8.63 (1.95)	9.89 (2.23)	8.95 (2.02)
10. Net Area Sown	157.14 (35.90)	164.68 (37.40)	179.42 (40.52)	185.49 (41.87)	186.56 (42.16)	191.42 (43.30)

Source : Bulletin of Agricultural Statistics, M.P. (Annual).

Note : Figures in parenthesis show percentage to total area.

barren and uncultivable land. An area of 28.1 lakh hectare (6.4 per cent) is under permanent pastures and grazing land. Remaining 227.9 lakh hectare (51.5 per cent) may be regarded as cultivable land, out of which 191.42 lakh hectare are under net sown area, 17.4 lakh hectare under fallow lands and 1.6 lakh hectare under miscellaneous tree crops and groves. About 17.8 lakh hectare area (4.0 per cent) is classified as culturable waste lands. Thus about 84 per cent of cultivable area is under current cropping.

The land use pattern in M.P. is not as imbalanced as is the case in U.P. Thus, nearly one-third area in the state is under forests as required from ecological point of view. The availability of pastures and grazing land is also relatively more in the state. Net sown area per capita (0.4 hectare) is considerably larger in M.P. as compared to U.P., while the proportion of area under current and old fallows is lower. The area under miscellaneous tree crops and groves is, however, relatively more in U.P. Large areas are, however, lying under culturable waste.

Table VI.5 shows period-wise shifts in area under different land use categories in M.P. between 1956-57 and 1985-86. Area under forests after showing some increase initially has been declining continuously since 1970-71. Over the entire period about 2.4 lakh hectare area under forests has been diverted to other uses. On the other hand area under non-agricultural uses has been steadily rising. Nearly 3.5 lakh hectare have been diverted to this category

Table VI.5

Period-wise Shifts in Area Under Different Land Use Categories
in U.P. : 1956-57 to 1985-86

(Unit - Lack Hectares)

Particulars	B E T W E E N						
	1956-61	1961-66	1966-71	1971-76	1976-81	1981-86	1986-91
	and 1961-66	and 1966-71	and 1971-76	and 1976-81	and 1981-86	and 1986-91	and 1991-96
1. Total Geographical Area	2.60 (0.59)	2.34 (0.53)	0.29 (0.07)	-0.57 (-0.13)	-0.36 (-0.08)	4.30 (0.98)	-0.64 (-0.14)
2. Forests	5.56 (4.03)	2.39 (1.67)	-1.38 (-1.29)	-1.96 (-1.36)	-1.70 (-1.20)	2.41 (1.75)	-5.54 (-3.80)
3. Land Put to Non-Agriculture Uses	1.49 (7.82)	0.14 (0.68)	0.29 (1.40)	0.98 (4.67)	0.56 (2.55)	3.46 (18.16)	1.83 (8.85)
4. Barren and Uncultivable Land	-2.61 (-10.54)	0.66 (2.98)	0.19 (0.83)	0.12 (0.52)	0.26 (1.12)	-1.38 (-5.57)	0.57 (2.50)
5. Permanent Pastures & Other Grazing Lands	6.40 (18.38)	-8.09 (-19.66)	-1.77 (-5.34)	-2.56 (-8.16)	-0.70 (-2.43)	-6.71 (-19.27)	-5.03 (-15.18)
6. Land Under Miscellaneous Tree Crops and Groves	-0.34 (-9.83)	-1.90 (-60.90)	0.18 (14.75)	0.06 (4.29)	0.10 (6.85)	-1.90 (-54.91)	0.34 (27.87)
7. Culturable Waste lands	-10.82 (-29.80)	-2.91 (-11.42)	-2.10 (-9.30)	-1.19 (-5.81)	-1.50 (-7.78)	-18.53 (-51.03)	-4.80 (-21.26)
8. Current Fallows	-0.68 (-7.91)	-0.25 (-3.16)	0.08 (1.04)	1.67 (21.55)	-0.97 (-10.30)	-0.15 (-1.74)	0.78 (10.17)
9. Old Fallows	-3.88 (-24.94)	-2.18 (-18.66)	-0.87 (-9.16)	1.26 (14.60)	-0.94 (-9.50)	-6.61 (-42.48)	-0.55 (-5.79)
10. Net Area Sown	7.54 (4.80)	14.74 (8.95)	6.07 (3.38)	1.07 (0.58)	4.86 (2.61)	34.28 (21.81)	12.00 (6.69)

Source : Bulletin of Agricultural Statistics, M.P. (Annual).

Note : Figures in parenthesis show per cent change.

from other categories, partly from the barren and uncultivable land which has declined by 1.4 lakh hectare. An undesirable trend to be observed is the sharp decline in area under permanent pastures and grazing land and area under miscellaneous trees and groves. However, old fallows have declined markedly and current fallows marginally over the period. Culturable wastelands have declined drastically by 18.5 lakh hectare or 51 per cent. It looks that due to increasing population pressure and expansion of irrigation facilities areas under fallows, grazing land, tree crops and culturable wastelands is being brought under cultivation. Thus, net sown area has increased by 34.3 lakh hectare or 21.8 per cent. However, the rate of expansion of net sown area has gone down after 1970-71.

Over the entire period proportion of net sown area to total area has gone up sharply from 35.9 per cent to 43.3 per cent (Table VI.4), while area under non-agricultural uses shows a rise from 4.4 per cent to 5.1 per cent. Proportion of area under forests has remained more or less static. All other land use categories show a clear decline in their share, which is more noticeable in case of culturable wastes, old fallows and pastures and grazing land.

The log-linear regression estimates and computed growth rates for the period 1970-71 and 1984-85 in M.P. for different land use categories have been given in Table VI.6. All the coefficients were found highly significant except for

Table VI.6

Log Linear Regression Estimates on Area Under Major Land Use
Categories in M.P. : 1970-71 to 1984-85

Land Use Categories	Constant	Beta	T Value	R ²	F-Value	Average Compound Growth Rate (%)
1. Forest	9.5841	-0.0026*	8.8	0.92	77.1	-0.25
2. Barren and Unculturable Land	7.7371	0.0014*	2.5	0.34	6.3	0.14
3. Land Put to Non-Agricultural Uses	7.6238	0.0072*	9.4	0.87	88.3	0.72
4. Culturable Waste	3.8293	-0.0072*	4.7	0.63	21.8	-0.71
5. Permanent Pastures & Other Grazing Lands	8.0863	-0.0114*	10.8	0.90	116.8	-1.14
6. Land Under Miscellaneous Tree Crops and Groves	4.8629	0.0154*	3.9	0.54	15.1	1.55
7. Current Fallows	6.6034	0.0191*	3.0	0.41	8.8	1.93
8. Other Fallows	2.5133	0.0077	0.5	0.02	0.2	0.77
9. Net Area Sown	9.8147	0.0028*	5.6	0.66	31.1	0.28

* Significant at 1 per cent level.

area under other fallows. The rates of growth were also found to be relatively high as compared to those for U.P. Thus, the land use pattern is undergoing much more sharp changes in M.P. as compared to U.P. where the pattern is more stable and possibilities of shifts more restricted.

VI.4 District Level Pattern of Land Use

Both the states of U.P. and M.P. comprising the Central Zone only large geographical entities with significant variations at the district/regional in elevation, climate, rainfall, soil, temperature, etc. as well as in density of human and livestock population. Hence it is natural to find significant inter-district variations in the pattern of land use, which must be kept in mind while preparing area specific land use plans. We, therefore, now propose to discuss the pattern of land use at the district level. The analysis is based on the distribution of area under the nine-fold land use categories taking the three yearly average for the period 1983-84, 1984-85 and 1985-86. The proportion of area under different land use categories for the districts of U.P. and M.P. has been shown in Appendix VI.1(i) and VI.1(ii) respectively. Cartographic presentation of data for each land use category has been given in Maps VI.1 to VI.9.

Forests : As can be seen from Table VI.7 and Map.VI.1 area under forests is very unevenly distributed. In U.P. forests are mainly confined to the Himalayan region and the bordering tarai belt. The U.P. Plains have been almost completely

Table VI.7

Distribution of Districts According to Percentage
of Area Under Forest to Total Reported Area
in Central Zone

Per cent Area Under Forests	U. P.	M. P.
Below 2.5	28	4
2.5 - 5.0	4	-
5.1 - 10.0	7	3
10.1 - 20.0	6	13
20.1 - 40.0	2	18
40.1 - 60	5	6
60.1 and Above	4	1
All Districts	56	45

denuded of its forest wealth, with as many as 28 districts having less than 2.5 per cent forest coverage. This is a critical region which should receive urgent attention in afforestation programmes. In M.P. the area under forests is relatively larger and well distributed over space. In general the forest coverage is better in southern and eastern parts of the state. In 4 districts of the state forest area is less than 2.5 per cent and in another 16 districts it is between 5 and 20 per cent of total area.

Land Under Non-Agricultural Uses : The distribution of land under non-agricultural uses has been shown in Table VI.8 and

Map VI.2. The proportion of area under this category is relatively larger in districts of U.P., particularly in western and eastern regions. Majority of districts in U.P. has over 7.5 per cent of area under non-agricultural uses, while only 5 districts of M.P. fall in this category. Generally a larger proportion of area under non-agricultural uses is related to the level of urbanisation, industrialisation and infrastructural development. This seems to be true for districts of Western U.P., but in Eastern U.P. larger area under water bodies has probably pushed up area under this category. In hilly districts and districts with larger area under forests this proportion is generally found to be lower.

Table VI.8

Distribution of Districts According to Percentage of Land Under Non-Agricultural Uses to Reported Area in Central Zone
(Nos.)

Per cent of Area Under Non-Agricultural Uses	U.P.	M.P.
Below 2.5	6	1
1.5 to 5.0	1	20
5.0 to 7.5	9	20
7.5 to 10.0	18	5
Above 10.0	22	-
All Districts	56	45

Barren and Uncultivable Land A fairly large proportion of area in the Central Zone is under the category of barren and uncultivable land but the proportion varies considerably from district to district largely depending on topographical situation (Table VI.9 and Map VI.3). In general the proportion of barren land is lower U.P. Plains particularly in tarai and eastern region and in southern and eastern parts of M.P. In 10 districts of U.P. and 14 districts of M.P. between 5 and 10 per cent of area is barren and uncultivable, while in 1 district of U.P. and 7 districts of M.P. this figure exceeds 10 per cent. These districts usually fall in the hilly region, Bundelkhand plateau and Chambal ravines.

Table VI.9

Distribution of Districts According to Percentage of Barren and Unculturable Land to Reported Area in Central Zone

(Nos.)

Per cent Area Under Barren and Unculturable Land	U.P.	M.P.
Below 1.0	4	4
1.0 - 2.5	20	12
2.5 - 5.0	21	8
5.1 - 7.5	8	5
7.6 - 10.0	2	9
10.1 and Above	1	7
Total	56	45

Pastures and Grazing Land In U.P. pastures and grazing lands have practically disappeared except in some of the hill districts inspite of a large livestock population. As a result the problems of shortage of grass and overgrazing have become very acute with consequential environmental damage. In Madhya Pradesh, however, the availability of pastures and grazing lands is fairly adequate with as many as 29 districts having more than 5 per cent of area under permanent pastures and grazing land (Table VI.10 and Map VI.4). But the grazing lands are not in a well kept position and their productivity is low. The practice of controlled grazing is also absent.

Table VI.10

Distribution of Districts According to Percentage of Area Under Pastures and Grazing Land in Central Zone

(Nos.)

Percentage of Area Under Pastures & Grazing Land	U.P.	M.P.
Upto 0.5	40	1
0.5 to 1.0	9	-
1.1 to 3.0	3	4
3.1 to 5.0	-	9
5.1 to 7.0	2	14
7.1 to 9.0	1	8
9.1 and Above	1	9
All Districts	56	45

Land Under Tree Crops and Groves : This category accounts for a very small proportion of total area in the majority of districts (Table VI.11 and Map VI.5). In U.P. area under tree crops and groves are found scattered throughout the state. Only in the hills large areas under this category are observed. In U.P. Plains area under tree crops and groves is relatively more in central and eastern region as compared to western and Bundelkhand region. In M.P. in as many as 38 districts area under this category is less than 0.5 per cent of total area. However, there is a good potential for growing citrus fruits in the state.

Table VI.11

Distribution of Districts According to Percentage of Area Under Miscellaneous Tree Crops and Groves in Central Zone

	(Nos.)	
Percentage of Area Under Tree Crops and Groves	U.P.	M.P.
Upto 0.5	14	38
0.5 to 1.0	10	3
1.1 to 2.0	16	2
2.1 to 3.0	9	-
3.1 to 5.0	2	2
5.1 and Above	5	-
All Districts	56	45

Culturable Wasteland : Large tracts of culturable wasteland are found all over the Central Zone (VI.12 and Map VI.6). In U.P. less than 2.5 per cent area is under culturable wastelands in 30 districts, while in 18 districts this area is between 2.5 and 5.0 per cent and in 8 districts more than 5 per cent. The corresponding figures for M.P. are 15, 19 and 11 respectively. In the U.P. Plains relatively larger area is found under wastelands in the Central parts and some districts of East U.P. The extent of culturable waste is generally higher in the districts of Madhya Pradesh particularly in the districts falling in the upper and the Central parts of the state and in Baster region.

Table VI.12

Distribution of Districts According to Per cent of Culturable Waste Land to Total Reported Area in Central Zone

(Nos.)

Per cent Area Under Culturable Waste	U.P.	M.P.
Below 1.0	6	4
1.0 - 2.5	24	11
2.6 - 5.0	18	19
5.1 - 7.5	2	6
7.6 - 10.0	3	2
10.1 and Above	3	3
Total	56	45

Current Fallows : Extent of current fallows shows fairly large variations across districts (Table VI.13 and Map VI.7). In U.P. there are 18 districts which have less than 2.5 per cent area under this category, another 18 districts have between 2.5 to 5.0 per cent of area under this category, while in 20 districts this proportion is between 5.0 and 10.0 per cent. In general the extent of current fallows is lower in Hill and Western Region, while it is highest in Central parts of the state which are suffering from the problem of salinity and alkalinity. In M.P. area under current fallows is relatively lower with as many as 32 districts having less than 2.5 per cent area under this category. Extent of fallow lands is relatively lower in the Western parts of the state and highest in the middle parts, with eastern parts falling in the medium range.

Table VI.13

Distribution of Districts According to Per cent Area Under Current Fallows in Central Zone (Nos.)

Per cent Area Under Current Fallows	U.P.	M.P.
Below 1.0	7	17
1.0 to 2.5	11	15
2.5 to 5.0	18	11
5.1 to 7.5	14	2
7.5 and Above	6	-
All Districts	56	45

Old Fallows : This category accounts for less than 2.5 per cent of total area in majority of the districts of Central Zone (Table VI.14 and Map VI.8). The extent of old fallows is relatively larger in U.P., particularly in central parts, as compared to M.P. The general pattern of distribution of area under old fallows is quite similar to that of current fallows.

Table VI.14

Distribution of Districts According to Per cent Area Under Old Fallows in Central Zone

			(Nos.)	
Per cent Area Under Old Fallows		U.P.	M.P.	
Below	1.0	11	17	
1.0	to 2.5	20	15	
2.6	to 5.0	17	12	
5.1	and Above	8	1	
All Districts		56	45	

Net Sown Area : Proportion of net sown area to total area also shows large variations from as low as 3.9 per cent in Chamoli district to 81.9 per cent in Mathura district in U.P. and from 21.4 per cent in Bastar district to 75.3 per cent in Bhind district in M.P. (Table VI.15 and Map VI.9). The

differences in proportion of net sown area to total area reflect the differences in geographical conditions and demographic pressure. Throughout the U.P. Plains forests have been almost completely destroyed and nearly the entire cultivable area has been brought under the plough. The area is endowed with rich soils and water resources and favourable climatic conditions. The density of human and livestock population is very high. With few exceptions over 60 per cent of area is under cultivation, the proportion exceeds the figure of 75 per cent in a good number of districts in West U.P. and in some districts of East U.P. In Hill Region, however, the proportion of net sown area is relatively low.

Table VI.15

Distribution of Districts According to Per cent of Net Sown Area to Total Area in Central Zone

(Nos.)

Per cent of Net Sown Area to Total Sown Area	U.P.	M.P.
Below 15.0	5	-
15.0 to 30.0	3	3
30.1 to 45.0	2	15
45.1 to 60.0	4	19
60.1 to 75.0	29	7
75.1 and Above	13	1
All Districts	56	45

In M.P., where soil and water situation is not as suitable and population density is low comparatively lower proportion of area has been brought under cultivation with 18 districts having less than 45 per cent and 19 district having between 45 and 60 per cent area under this category, while 8 districts have over 60 per cent area under this category. Inter-district variations in proportion of net sown area are thus considerably larger in M.P. In general the proportion of net sown area increases as one moves from east to west.

We may here look at the possibility of further expansion of cultivated area in the Central Zone. Table VI.16 and Map VI.10 depict the proportion of net sown area to total cultivable area, which includes in addition to the net sown area, area under current and old fallows, culturable wastes

Table VI.16

Distribution of Districts According to Proportion of
Net Sown Area to Total Cultivable Area in Central Zone
 (Nos.)

Net Sown Area As Per cent of Total Cultivable Area	U.P.	M.P.
Below 65.0	5	1
65.0 to 75.0	3	5
75.1 to 85.0	19	11
85.1 to 95.0	25	21
95.1 and Above	4	7
All Districts	56	45

and area under miscellaneous tree crops. In a large majority of districts - 29 in U.P. and 28 in M.P. - over 85 per cent of cultivable area is already under current cropping. In the remaining 26 districts of U.P. and 18 districts of M.P. the possibility of further expansion of net sown area is relatively larger. Majority of these districts fall in the U.P. Hills and Central parts of U.P. and M.P. whether this area should be reclaimed for cultivation or diverted to other uses as grazing land or forests is an issue which needs careful consideration in the light of the local circumstances.

VI.5 District Level Trends in Land Use

District level trends in area under different land use categories over the period 1968-69 and 1985-86 have been analysed by fitting log linear regressions on time series data. Appendix VI.2(i) and VI.2(ii) give the district-wise log linear growth rates in area under different land use categories in U.P. and M.P. respectively, while Table VI.17 and VI.18 show the distribution of districts according to the range of growth rates in the two states respectively. A look at these tables clearly brings out the fact that the state level trends conceal the large inter-district variations in the changes in the land use pattern in the Central Zone.

In U.P. we find that forest area is showing a decline in as many as 27 districts, the rate of decline is fairly sharp in 9 districts. On the other hand 27 districts show a rise

Table VI.17

Distribution of Districts According to Log Linear Growth Rate in Area Under Different Land Use Categories in U.P. - 1968-69 to 1985-86

Log Linear Growth Rate Per cent (Per annum)	Forest	Barren & Un- cultura- ble Land Uses	Land Put to Non- Agricultural Uses	Cultura- ble Waste- land	Perma- nent Pas- tures Grazing Land	Land Under Miscella- neous Tree Crops and Groves	Current Fallow	Other Fallow	Net Sown Area
Negative	27	35	3	50	23	54	18	11	31
Upto 1.0	18	11	2	4	4	50	2	4	30
1.0 to 3.0	8	15	1	11	11	4	7	4	-
Above 3.0	1	9	-	35	8	-	9	3	1
Positive	27	19	51	4	31	-	36	43	23
Upto 1.0	17	9	30	-	8	-	6	4	20
1.0 to 3.0	7	5	20	3	6	-	8	10	1
3.0 to 5.0	2	3	1	1	6	-	10	17	2
Above 5.0	1	2	-	-	11	-	12	12	-
All Districts	54	54	54	54	54	54	54	54	54

Table VI.18

Distribution of Districts According to Log Linear Growth Rate in Area Under
Different Land Use Categories in M.P. - 1970-71 to 1985-86

Log Linear Growth Rate Per cent (Per annum)	Forest	Barren & Un- cultura- ble Land	Land Put to Non- Agricultural Uses	Cultura- ble Waste- land	Perma- nent Pas- tures Other Grazing Land	Land Under Miscella- neous Tree Crops and Groves	Current Fallow	Other Fallow	Net Sown Area
Negative	32	22	7	31	35	6	8	18	9
Upto 1.0	27	14	4	13	11	3	4	9	8
1.0 to 3.0	2	5	2	8	17	2	2	3	1
Above 3.0	3	3	1	10	7	1	2	6	-
Positive	13	23	38	14	10	5	37	27	36
Upto 1.0	7	13	28	4	4	2	11	10	32
1.0 to 3.0	3	4	8	5	3	3	14	15	4
3.0 to 5.0	-	3	1	2	2	-	6	1	-
Above 5.0	3	3	1	1	1	-	6	1	-
All Districts	45	45	45	45	45	11	45	45	45

in forest area. Similarly area under barren and uncultivable land has declined in 35 districts but shows a rising trend in 19 districts. With the exception of 3 districts all districts of U.P. show a rising trend in area under non-agricultural uses, but the growth rate was below 1 per cent in 30 districts and above 1 per cent in 21 districts. Higher growth rate in this category has taken place in eastern districts. Culturable wastelands have shown a fairly high negative growth rate in all districts of U.P. Plains, but in 4 hill districts area under this category shows a rise.

Area under pastures and grazing land shows a mixed trend across districts, but area under miscellaneous tree crops and groves has declined all over. In case of area under current and old fallowss we find that though this area has declined in some districts, it shows a positive trend in many cases fairly high in a majority of districts in the state. The reasons for this phenomenon need to be examined and corrective action taken to check it. Finally, in case of net sown area we find a mixed trend. Though at the state level net sown area shows no trend, it shows a negative trend in 31 districts but a positive trend in 23 districts. Of the districts showing a growth of net sown area 11 are in West U.P., 5 in Hill Region, 3 each in Bundelkhand and Central U.P. and only 1 in East U.P.

In Madhya Pradesh we find that as many as 32 districts show a negative trend in area under forests, while only 13

districts show a positive trend (Table VI.18). Barren and unculturable land has also increased in as many as 23 districts though it has declined in 22 districts. As far as land put to non-agricultural uses is concerned we find a positive trends in 38 districts and a negative trend in 6 districts. Culturable wasteland is showing a declining trend in majority of districts as net sown area is expanding, but a few districts show an expansion in area under this category. Another undesirable trend noticeable is the negative trend for area under pastures and grazing land.

Unlike U.P. most of the districts in M.P. show a decline in area under the category current and old fallows, though a few districts show a rising trend as well. As many as 37 districts in M.P. show a positive trend in net sown area, though the growth rate was less than 1 per cent in most of these districts. In 8 districts, however, a negative trend in net sown area was observed, mainly on account of growth of fallow land or land under non-agricultural uses.

VI.6 Conclusion

To conclude, the study reveals serious imbalances in the land use pattern in U.P. due to very heavy pressure of human and livestock population. The forest coverage in the state is very low and geographically concentrated. Area under pastures and grazing land has nearly disappeared. Extension of cultivation has reached its limits. In contrast in M.P.

the imbalances in land use pattern are not as serious as in U.P. Nearly one-third area in the state is under forests and the availability of pastures and grazing land is relatively better. Potential for expansion of cultivated area has also not been fully exhausted. At the same time in both the states we find that considerable areas are not being put to productive use being under culturable wastelands or lying fallow for various reasons. Period-wise analysis revealed a greater stability in land use pattern in U.P. as compared to M.P.

The state level picture conceals high degree of variation in the patterns and trends of land use at the district level. Some of the undesirable trends in land use pattern observed are an increase in area under categories like barren and unculturable land, culturable waste land as well as in area under current and other fallows on the one hand and decrease in net sown area as well as area under pastures and grazing land, land under miscellaneous tree crops and groves as well as forest area in some districts on the other hand. There is a need of micro level studies to identify the reasons behind these trends so that needed corrective action may be taken. In any perspective land use plan these inter-districts variations in land use patterns and trends have to be taken into account.

Appendix VI.1(i)

Percentage of Area Under Different Land Use Categories to Total Reporting
Area in U.P. : Average for 1983-84, 1984-85 and 1985-86

Districts	Forest	Barren & Unculturable Land	Land Put to Non-Agricultural Uses	Culturable Waste-land	Perma- nent Pas- tures Other Grazing Land	Land Under Miscella- neous Tree Crops and Groves	Current Fallow	Other Fallow	Net Sown Area
1	2	3	4	5	6	7	8	9	10
1. Agra	8.30	2.91	8.01	0.27	1.36	0.29	3.87	2.41	72.57
2. Aligarh	0.18	6.56	7.97	0.55	1.80	0.23	2.69	2.28	77.74
3. Bareilly	0.07	3.18	10.16	0.10	0.92	0.27	2.40	1.31	81.58
4. Bijnor	14.30	1.66	10.67	0.15	0.68	0.55	1.10	0.54	70.34
5. Budaun	1.33	3.14	7.96	0.13	1.42	1.69	4.77	2.60	76.95
6. Bulandshahr	2.15	3.50	8.42	0.37	2.45	0.50	2.40	2.07	78.09
7. Etah	0.25	2.75	8.43	0.24	8.68	0.70	5.41	6.33	66.72
8. Etawah	9.00	6.04	7.40	0.52	2.43	0.32	4.23	3.91	66.14
9. Farrukhabad	0.98	5.15	9.51	0.73	4.87	2.45	5.68	5.18	65.45
10. Meerut	2.04	1.64	11.78	0.11	1.08	0.10	1.86	1.42	79.93
11. Gaziabad	0.99	3.74	13.43	0.19	2.78	0.41	2.96	2.98	72.47
12. Mainpuri	1.50	8.88	6.64	0.62	3.48	0.63	5.54	6.82	65.91
13. Mathura	0.42	1.71	7.93	0.45	1.86	0.36	2.89	2.49	81.89
14. Moradabad	2.01	2.46	7.83	0.17	2.03	0.01	2.76	1.21	81.44
15. Muzaffarnagar	1.76	2.83	11.34	0.17	1.10	0.39	1.60	1.10	79.71
16. Pilibhit	22.53	1.37	8.34	0.07	1.39	0.71	1.35	1.20	63.03
17. Rampur	2.81	3.24	9.96	0.00	0.46	0.17	1.69	0.88	80.79
18. Saharanpur	14.31	1.12	12.09	0.09	0.90	0.22	1.19	0.66	69.40
19. Shahjahanpur	2.31	2.37	8.20	0.28	1.65	1.21	5.08	2.54	76.33
20. Barabanki	1.72	2.44	12.68	0.48	2.83	2.85	7.14	5.03	64.84
21. Fatehpur	1.43	3.52	10.31	0.74	3.30	1.37	4.60	3.65	71.09
22. Hardoi	1.24	3.45	8.09	0.88	3.92	2.45	8.17	3.87	67.92
23. Kanpur	1.88	8.69	8.36	0.72	2.87	1.57	4.19	3.60	68.28
24. Lakhimpur- Kheri	21.39	0.98	10.10	0.15	0.84	1.21	5.23	1.33	58.84
25. Lucknow	4.52	4.25	9.36	1.33	4.73	2.31	8.21	5.36	59.93
26. Rae Bareli	1.43	5.70	10.15	0.88	5.51	5.31	8.59	4.59	57.84
27. Sitapur	0.88	1.47	10.42	0.11	1.76	1.30	8.09	2.87	73.08
28. Unnao	3.45	4.83	8.59	0.78	4.18	1.84	8.71	6.91	60.72
29. Allahabad	2.74	5.06	10.60	0.16	3.77	2.43	6.02	4.66	64.55
30. Azamgarh	0.05	2.31	11.45	0.30	2.30	2.14	4.52	2.79	74.41
31. Bahraich	14.79	1.31	9.69	0.13	1.75	1.51	4.03	1.58	65.21
32. Ballia	N.A.	5.60	11.59	0.05	0.85	1.78	4.31	2.16	73.45
33. Basti	0.88	1.00	10.93	0.28	2.47	2.40	2.56	2.27	77.20
34. Deoria	0.22	2.07	10.92	0.07	1.32	1.67	2.03	1.36	80.35

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Appendix VI.1(i) Contd.

1	2	3	4	5	6	7	8	9	10
35. Faizabad	0.29	1.82	13.20	0.46	2.84	4.97	6.10	3.18	67.14
36. Ghazipur	N.A.	1.98	10.25	0.35	1.71	1.01	4.86	2.34	77.49
37. Gonda	9.69	1.06	10.16	0.25	1.82	2.27	5.51	2.47	66.76
38. Gorakhpur	8.48	0.79	9.63	0.05	1.00	0.98	1.74	1.59	75.73
39. Jaunpur	0.06	2.10	9.84	0.39	2.31	1.68	6.79	4.28	72.54
40. Mirzapur	40.64	4.34	6.41	0.17	4.94	1.62	5.61	5.67	30.61
41. Pratapgarh	0.13	3.47	10.72	0.22	2.70	5.63	9.67	4.76	62.71
42. Sultanpur	0.50	4.24	10.19	0.47	3.89	1.96	6.75	5.66	66.35
43. Varanasi	14.93	2.40	10.43	0.05	1.27	1.81	3.89	2.01	63.00
44. Almora	53.72	4.31	2.26	7.63	8.86	6.09	0.13	0.82	16.18
45. Chamoli	59.10	20.04	2.01	5.64	3.53	4.42	0.03	0.17	5.05
46. Dehradun	69.54	0.55	5.12	0.01	3.63	1.39	1.06	1.02	17.68
47. Nainital	57.61	0.76	4.38	0.18	4.37	2.06	0.54	0.73	29.36
48. Pithoragarh	52.10	4.20	2.12	12.35	9.56	6.42	0.26	1.37	11.61
49. Pauri Garhwal	62.16	3.81	2.12	5.21	4.86	6.88	0.32	1.35	13.27
50. Tehri Garhwal	69.44	1.73	1.33	2.37	11.62	0.07	0.28	0.76	12.39
51. Uttar Kashi	88.72	1.76	0.50	2.01	2.02	0.76	0.08	0.27	3.89
52. Banda	10.19	5.39	5.26	0.04	5.19	1.16	4.26	3.22	65.29
53. Hamirpur	5.29	3.32	6.58	0.12	4.66	0.29	4.64	3.55	71.56
54. Jalaun	5.64	3.23	6.53	0.03	1.60	0.64	4.02	1.83	76.46
55. Jhansi	6.51	6.37	7.36	0.18	10.54	0.43	3.43	3.54	61.59
56. Lalitpur	13.20	3.74	5.29	1.42	25.59	0.51	4.98	6.19	39.04
Uttar Pradesh	17.20	3.71	7.96	1.12	3.75	1.86	3.80	2.73	57.88

Appendix VI.1(ii)

Percentage of Area Under Different Land Use Categories to Total Reporting
Area in M.P. : Average for 1983-84, 1984-85 and 1985-86

Districts	Forest & Un- culturable Land Uses	Barren & Un- culturable Land Uses	Land Put to Non- Agricultural Uses	Culturable Waste- land	Perma- nent Pas- tures Other Grazing Land	Land Under Miscella- neous Tree Crops and Groves	Current Fallow	Other Fallow	Net Sown Area
1	2	3	4	5	6	7	8	9	10
1. Raipur	36.53	6.30	1.08	6.86	-	2.16	1.55	1.46	44.05
2. Durg	11.48	8.27	1.15	8.27	-	2.64	2.18	2.18	63.83
3. Rajnandgaon	35.05	4.95	2.16	6.13	-	1.98	2.07	2.07	45.50
4. Bastar	62.75	2.18	3.25	3.68	-	4.28	1.23	1.20	21.43
5. Bilaspur	39.42	4.93	2.39	6.51	-	1.83	1.52	1.42	49.91
6. Sarguja	49.22	4.90	1.99	8.17	3.54	0.95	2.13	2.31	26.70
7. Raigarh	30.97	5.39	8.47	7.70	-	1.15	2.61	2.77	40.98
8. Jabalpur	15.71	5.53	8.20	9.78	0.19	7.01	4.24	3.95	45.55
9. Balaghat	49.67	4.12	6.07	3.79	0.54	2.81	1.62	1.40	29.93
10. Chindwara	37.45	4.21	4.03	4.86	-	2.16	2.76	2.76	41.77
11. Seoni	36.73	4.13	0.91	4.24	-	3.78	3.32	2.98	43.85
12. Mandla	42.98	4.14	4.82	3.14	-	2.94	4.98	4.67	32.85
13. Narsinghpur	26.51	4.48	0.19	5.65	-	5.06	1.55	1.36	35.16
14. Sagar	28.54	4.10	1.85	12.41	0.09	0.29	1.17	0.57	50.34
15. Damoh	36.21	3.43	5.21	8.36	0.69	4.80	1.50	1.23	38.54
16. Panna	33.71	4.83	13.79	1.70	-	10.38	2.84	2.56	30.44
17. Tikamgarh	12.50							2.77	47.22
18. Chhatarpur	9.96	5.33	12.05	10.89	-	12.39	5.56	4.17	39.62
19. Rewa	10.65	8.90	6.67	6.85	0.15	1.58	4.13	3.81	57.85
20. Shidhi	42.15	5.00	9.62	-	-	3.46	3.46	3.36	33.10
21. Satna	17.92	7.68	11.16	3.09	1.07	6.60	2.42	2.29	47.97
22. Shahdol	38.96	5.98	4.04	3.89	0.07	3.97	5.05	4.90	32.90
23. Indore	13.57	7.04	0.78	8.35	-	1.56	0.52	0.52	67.62
24. Dhar	14.02	4.63	8.78	6.95	-	2.68	0.73	0.73	60.85
25. Jhabua	16.64	5.30	15.17	7.06	-	1.62	1.32	1.17	50.81
26. Khargone	34.84	3.70	4.22	7.26	-	2.44	0.59	0.51	46.40
27. Khandwa	45.54	3.47	1.78	6.93	0.09	0.45	0.90	0.63	40.05
28. Ujjain	1.30	5.88	1.47	12.58	-	2.45	0.65	0.65	75.16
29. Mandsaur	11.20	9.94	10.57	5.71	-	4.86	0.32	0.32	57.08
30. Rattam	7.18	5.13	8.82	7.18	-	6.57	0.61	0.61	63.65
31. Dewas	29.14	4.57	2.00	12.28	-	0.71	0.42	0.28	50.57
32. Shajapur	0.48	6.79	8.57	9.87	-	5.01	0.48	0.32	68.60

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Appendix VI.i(ii) Contd.

1	2	3	4	5	6	7	8	9	10
33. Morena	27.82	5.56	17.55	5.73	-	7.61	0.77	0.85	34.16
34. Bhind	1.57	6.51	6.96	5.61	-	0.45	0.89	0.89	75.28
35. Gwalior	20.88	6.32	10.91	4.40	-	5.36	1.84	1.34	49.42
36. Shivpuri	18.87	6.58	9.83	6.29	4.12	13.56	2.35	2.26	36.28
37. Guna	13.84	5.19	9.47	5.73	-	9.56	0.72	0.72	50.82
38. Datia	9.80	4.90	6.66	2.94	1.96	4.90	1.47	1.47	65.19
39. Bhopal	14.39	9.23	1.11	12.55	-	4.43	0.37	0.74	57.56
40. Sehore	26.22	4.73	1.37	7.77	0.15	3.96	0.30	0.30	55.18
41. Raisen	39.34	4.36	0.35	3.53	-	2.59	0.35	0.35	48.88
42. Vidisha	14.38	4.93	1.51	5.62	-	2.60	0.41	0.41	70.00
43. Betul	40.38	4.37	2.68	2.08	-	4.37	3.27	2.98	39.98
44. Rajgarh	2.29	6.05	4.90	14.54	-	4.90	0.82	0.65	65.85
45. Hushangabad	36.04	3.20	3.10	5.51	0.10	3.90	1.40	1.10	45.25
Madhya Pradesh	31.73	8.08	5.26	6.34	0.34	3.90	1.93	1.81	43.61

Appendix VI.2(i)

Districtwise Log Linear Growth Rate in Area Under Different Land Use
Categories in U.P. : 1968-69 to 1985-86

(Per cent Per Annum)

Districts	Forest & Un- cultura- ble Land	Barren & Un- cultura- ble Land	Land Put to Non- Agricultural Uses	Cultura- ble Waste- land	Perma- nent Pas- tures Other Grazing Land	Land Under Miscella- neous Tree Crops and Groves	Current Fallow	Other Fallow	Net Sown Area
1	2	3	4	5	6	7	8	9	10
1. Agra									
2. Aligarh	-0.55	-0.93	0.69	-1.69	0.06	-0.11	1.49	2.28	0.03
3. Bareilly	-2.00	0.41	0.61	-5.14	0.16	-0.12	-2.78	3.96	4.53
4. Bijnor	0.15	-1.85	0.45	-10.21	-1.47	-0.08	-10.63	-1.67	0.55
5. Budaun	0.28	0.05	0.52	-4.89	-1.33	-0.04	2.06	5.70	-0.11
6. Bulandshahr	0.49	-2.94	0.07	-5.06	-1.88	-0.09	-0.80	2.26	-0.76
7. Etah	-2.99	-0.64	1.31	-1.84	0.13	-0.09	3.51	6.80	-0.31
8. Etawah	-0.03	-3.29	0.54	-2.86	-0.49	-0.06	2.76	3.39	-0.10
9. Farrukhabad	-2.25	-1.6	0.70	-2.90	0.16	-0.02	4.53	5.37	-0.27
10. Meerut	0.14	-0.79	2.61	-4.14	3.97	-0.08	0.41	4.01	0.79
11. Mainpuri	-0.56	-3.69	0.75	-2.34	0.58	-0.04	3.42	6.55	0.06
12. Mathura	-0.18	-0.42	0.93	-0.99	0.18	-0.05	0.21	3.35	-0.02
13. Moradabad	0.49	-0.42	0.21	-3.13	-2.18	-0.08	-2.13	3.01	0.16
14. Muzaffarnagar	-21.18	-0.88	1.07	-7.81	-3.27	-0.08	-3.30	-0.47	0.19
15. Pilibhit	-0.07	0.44	-0.49	-8.07	-8.67	-0.08	-8.23	-2.47	0.62
16. Rampur	-0.08	2.08	0.58	-9.31	-4.89	-0.16	-4.54	-2.08	0.12
17. Saharanpur	0.68	-1.57	0.46	-6.56	-2.02	-0.10	-3.95	-0.72	0.25
18. Shahjahanpur	-1.03	-0.59	0.59	-8.43	0.85	-0.05	-2.39	2.50	0.57
19. Barabanki	4.99	0.55	0.51	-5.32	1.84	-0.05	5.42	7.38	-0.35
20. Fatehpur	-1.50	-1.36	0.16	-3.37	-1.28	-0.03	1.63	1.32	0.61
21. Hardoi	-0.94	-2.56	0.54	-3.69	0.63	-0.03	0.57	1.61	0.32
22. Kanpur	-0.10	-1.28	0.93	-1.44	-1.25	-0.03	3.83	4.99	-0.15
23. Lakhimpur- Kheri	-0.46	3.11	0.45	-10.63	-1.50	-0.05	-1.10	-5.95	0.32
24. Lucknow	0.33	-3.65	0.18	-3.34	-1.90	-0.05	7.00	3.36	-0.07
25. Rae Bareli	1.32	0.86	-0.13	-2.60	1.13	-0.01	6.26	4.83	-0.31
26. Sitapur	-1.20	1.46	0.62	-4.54	2.14	-0.06	1.86	4.52	-0.11
27. Unnao	0.72	-2.54	0.02	-4.26	-1.34	-0.05	5.66	4.60	-0.31
28. Allahabad	0.42	-0.28	0.41	-3.68	3.08	-0.01	0.62	5.41	-0.08
29. Azamgarh	1.90	-3.52	1.67	-4.72	6.12	-0.02	4.63	4.97	-0.20
30. Bahraich	0.02	-0.41	1.16	-5.08	-4.40	-0.04	3.56	-1.29	-0.001
31. Ballia	-	-1.59	1.42	-7.23	11.63	-0.05	3.99	4.56	-0.05
32. Basti	1.17	1.47	0.52	-3.67	-0.92	-0.01	-0.33	4.27	-0.02
33. Deoria	0.41	0.24	2.60	-2.41	5.10	-0.04	-2.41	-0.58	-0.03

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Appendix VI.2(i) Contd.

1	2	3	4	5	6	7	8	9	10
34. Faizabad	-0.08	-2.02	1.15	-4.84	9.15	-0.02	8.37	0.39	-0.15
35. Ghazipur	-	-1.49	1.64	-4.63	3.33	-0.07	11.96	3.75	-0.29
36. Gonda	-0.08	3.57	0.84	-6.09	7.63	-0.02	7.10	1.66	-0.39
37. Gorakhpur	0.002	1.20	1.35	-3.48	0.17	-0.07	9.42	1.30	0.24
38. Jaunpur	10.28	-3.34	1.80	-4.81	3.09	-0.03	3.82	2.65	-0.16
39. Mirzapur	-0.54	-3.30	1.71	-5.40	-5.07	-0.05	30.46	-0.86	-0.02
40. Pratapgarh	3.36	-4.22	0.75	-4.14	3.58	-0.02	17.16	4.65	-0.82
41. Sultanpur	2.61	-2.81	0.77	-1.56	11.20	-0.06	7.24	5.79	-0.50
42. Varanasi	0.04	-1.15	1.27	-3.52	11.45	-0.03	3.80	0.38	-0.30
43. Almora	-2.69	-43.84	-2.48	-17.22	33.16	0.27	-1.45	-46.25	3.97
44. Chamoli	-0.43	5.35	-	-1.37	3.17	-0.07	46.66	-7.39	0.42
45. Dehradun	2.25	0.31	0.28	-16.001	-7.31	-0.04	0.98	4.89	0.19
46. Nainital	1.01	-	1.58	-0.998	22.14	0.15	-1.46	5.13	1.14
47. Pithoragarh	-0.62	2.11	1.61	1.77	2.69	0.04	-13.34	5.62	0.35
48. Pauri-									
Garhwal	0.45	4.73	3.18	4.04	5.48	0.08	-8.60	11.96	-7.41
49. Tehri									
Garhwal	1.33	-6.07	0.70	2.35	-0.78	-0.21	-6.92	9.99	-0.79
50. Uttar Kashi	-0.003	10.28	0.88	2.53	-3.91	-0.02	-4.62	8.87	-0.91
51. Banda	0.86	-1.01	1.05	-0.57	10.04	-0.05	1.21	1.08	0.18
52. Hamirpur	-0.09	-1.46	1.19	-4.37	2.82	-0.02	1.06	1.24	0.13
53. Jalaun	-0.40	-1.39	1.32	-4.20	-3.55	-0.01	4.64	5.67	-0.25
54. Jhansi	-1.15	0.76	1.09	-2.08	1.38	-0.001	1.13	0.63	0.44
Uttar Pradesh	-0.03	-1.59	0.89	-3.84	1.95	-0.05	2.49	2.16	-0.01

Appendix VI.2(ii)

Percentage of Area Under Different Land Uses Categories to Total Reporting

Area in M.P. : 1970-71 to 1985-86

(Per cent per annum)

Districts	Forest	Barren & Unculturable Land	Land Put to Non-Agricultural Uses	Culturable Wasteland	Permanent Pastures Other Grazing Land	Land Under Current Miscellaneous Tree Crops and Groves	Other Fallow	Net Sown Area	
1	2	3	4	5	6	7	8	9	10
1. Raipur	-6.58								
2. Durg	-5.54	-7.25	0.87	1.89	-3.65		1.73	0.36	0.02
3. Rajnandgaon	2.66	-0.67	1.72	3.55	46.77		0.02	0.09	0.27
4. Bastar	-0.58	0.69	2.31	2.04	-2.92		0.38	-1.19	1.31
5. Bilaspur	-0.27	-0.15	1.06	0.26	-0.41			0.08	0.08
6. Sarguja	-0.75	-1.64	3.51	-3.70	0.97		1.45	3.14	0.56
7. Raigarh	-0.46	-0.49	0.35	-0.81	-0.66		0.45	1.31	-1.40
8. Jabalpur	-1.16	1.72	0.15	1.43	0.06	-1.42	3.12	1.24	-0.39
9. Balaghat	-0.53	10.69	-1.34	0.70	-0.52	1.60	4.69	0.98	-0.08
10. Chindwara	-0.33	1.49	0.99	-4.58	-0.03	-56.12	2.07	0.88	0.04
11. Seoni	0.32	-0.18	0.36	0.22	-1.14		5.10	-1.29	0.19
12. Mandla	-0.10	0.09	0.50	-0.57	-1.51			-0.15	-0.09
13. Narsinghpur	-0.05	-0.71	0.03		-4.29		2.80*	0.51	0.25
14. Sagar	-0.06	3.82	-0.07	-12.29	0.72		5.07	1.20	0.05
15. Damoh	-0.09	2.29	-0.43	-0.68	-1.32	-0.58	5.12	1.06	0.09
16. Panna	-0.02	0.03	0.28	-1.81	-1.02		3.42	-0.77	0.23
17. Tikamgarh	-0.31	0.46	0.35	-0.64	-1.11		2.97	-0.04	0.72
18. Chhatarpur	-0.17	-0.36	1.16	-4.64	4.04		6.14	-0.88	1.08
19. Rewa	-0.05	-0.88	0.46	-4.69	1.59	-0.77	2.10	0.29	-0.09
20. Shidi	0.25	-3.04	0.60	-0.84			2.50	1.86	0.36
21. Satna	-0.27	-0.14	0.26	-0.65	-1.38	0.69	1.93	1.17	0.19
22. Shahdol	6.75	-0.97	0.80	-6.61	1.20	-0.24	2.16	1.22	-0.45
23. Indore	-0.04	0.58	0.08	-0.42	3.04		0.40	0.56	0.17
24. Dhar	1.39	0.94	0.80	-2.86	-4.74		0.58	1.15	0.25
25. Jhabua	-0.01	0.23	0.71		-2.02		-1.12	1.60	0.36
26. Khargone	-0.07	0.99	0.54		-0.77		2.09	0.57	0.11
27. Khandwa	0.81	0.66	0.45	0.85	-2.38	-1.07	6.29	2.56	0.25
28. Ujjain	5.81	-2.52	0.59	-2.97	0.01		0.22	0.02	0.11
29. Mandasaur	-4.55	0.06	-3.59	-1.17	-3.60		-0.57	-0.28	-0.75
30. Rattlam	0.26	3.68	1.07	-1.12	-3.22		0.08	-3.11	1.80
31. Dewas	-0.63	-1.02	0.76	-6.51	-0.19		0.07	-3.07	0.22
32. Shajapur	-0.08	-1.70	2.35	-0.92	-3.77		-0.14	-3.17	1.00

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Appendix VI.2(i) Contd.

1	2	3	4	5	6	7	8	9	10
33. Morena		0.24	-0.04	-0.72	-1.10		2.56	2.20	0.16
34. Bhind	17.16	-0.23	0.03	2.76	-1.62		1.84	5.91	0.08
35. Gwalior	-0.06	-0.37	0.00001	-1.08	-2.16		2.15	2.75	0.36
36. Shivpuri	-0.14	0.16	0.51	-0.36	-2.90	2.54	0.41	-1.34	0.50
37. Guna	-0.17		0.58	-2.02	-2.42		3.86	-0.89	0.87
38. Datia	0.26	12.41	5.12	-26.48	-0.06	2.71	1.85	1.11	0.21
39. Bhopal	-1.01	-0.23	1.45	1.54	-2.45			-0.53	0.50
40. Sehore	-0.53	0.60	0.39	4.06	-6.65		-0.14	2.49	0.52
41. Raisen	0.31	3.67	1.00	5.49	-0.13		0.68	-0.86	0.54
42. Vidisha	1.56	-4.82	0.61	-4.40	-1.98		-3.31	-3.42	0.34
43. Betul	-0.22	-0.03	0.05	-0.86	-0.29		3.95	1.57	-0.11
44. Rajgarh	0.23	1.07	0.92	-0.71	-0.53		0.91	-3.09	0.22
45. Hushangabad	-0.14	7.22	-1.73		-2.48	0.82	5.32		0.13
Madhya Pradesh	-0.26	0.14	0.72		-1.14	1.55	1.93	0.77	0.28

CHAPTER VII

Trends in Cropping Pattern

VII.1 Introduction

The cropping pattern in a region is determined by a large number of geographical and economic factors. Geographical factors like soil, rainfall, climate, temperature variation, etc. determine the suitability of an area to grow particular crops. Area actually devoted to a particular crop will be determined by the economic factors like field levels, prices, cost of cultivation, etc. Relative profitability is an important factor in influencing the farmers' decision about area allocation to a crop. But in a subsistence oriented economy like ours, where only a part of produce is sold in the market, the need of domestic consumption acts as a major constraint on cropping pattern particularly in the case of small and marginal farmers. The dominance of foodgrains in the cropping pattern in India as well as in the Central Zone is basically explained by this factor.

In the present chapter we have discussed the cropping pattern in the Central Zone at the state as well as district level. The trends in the cropping pattern are examined over the post green revolution period i.e. after the mid-sixties.

VII.2 Cropping Intensity

Intensity of cropping as measured by the ratio of gross cropped area to net cropped area is an important indicator of the land utilization efficiency. In future the increase in output is to be obtained mainly through expansion of double cropped area and improvement in yield levels as the possibility of increasing net sown area is limited particularly in U.P. The intensity of cropping in U.P. has jumped from 132 to 146 over the period 1968-71 and 1983-86. The corresponding figures for M.P. are rather low 111 and 117 respectively.

Table VII.1

Distribution of District According to Intensity of Cropping in Central Zone, 1983-86

(Nos.)

Intensity of Cropping	U.P.	M.P.
Below 110	2	12
110 to 120	2	18
120 to 130	1	8
130 to 140	8	5
140 to 150	14	2
150 to 160	15	-
over 160	12	-
All Districts	54	45

Appendix VII.1 (i) and VII.1 (ii) show the intensity of cropping in U.P. and M.P. respectively, while a summary picture is given in Table VII.1. In U.P. intensity of cropping is below 130 in 5 districts, between 130 and 150 in 22 districts and over 150 in 27 districts. Intensity of cropping is relatively higher in the district of north west followed by districts of south west, while it is lowest in central parts of the state (Map VII.1). In M.P. intensity of cropping is below 120 in as many as 30 districts and between 120 and 130 in 8 districts. A group of districts in mid eastern parts has relatively higher density in the state.

The major factor responsible for low cropping intensity in M.P. is the lack of irrigation facilities. However in U.P. the proportion of double cropped area is less than the proportion of irrigated area and there is a possibility of increasing in good measure the area under multiple cropping.

VII.3 State Level Trends in Cropping Pattern

UTTAR PRADESH

The introduction of HYV seeds in the mid sixties has brought about a significant change in the cropping pattern in U.P. Appendix VII.2 (i) shows yearwise area under major crops in U.P. since 1968-69, while Table VII.2 depicts the changes over the entire period. The area under superior cereals like wheat and rice has expanded very rapidly throughout the period under consideration, while all coarse cereals and pulses have registered a very substantial decline in area devoted to them. Thus an additional area of 29.2 lakhs ha.

has been brought under wheat cultivation and 11.4 lakh ha. under rice cultivation over the period, while 14.8 lakh ha. area under coarse cereals and 11.6 lakh ha. area under pulses has been shifted to other crops. Among non-foodgrain crops area under oilseeds and sugarcane has gone up, though there are sharp year to year fluctuations. Potato area also shows a sharp increase. Area under cotton and groundnut has, however, declined.

As shown in Table VII.3 over 80 percent of cropped area in U.P. is devoted to foodgrains production, wheat alone accounting for 33.3 percent and rice for another 21.8 percent. Sugarcane is the most important commercial crop of U.P. followed by oilseeds. U.P. is also specializing in potato and vegetable cultivation. Over the period of significant positive shift in area has taken place in favour of wheat and rice, which is matched by an equally sharp negative shift in case of area under coarse cereals and pulses. The decline in the area under pulses is a very disconcerting trend as pulses are the major source of protein. The decline in coarse cereals has adverse effects on availability of fodder for livestock. Among non foodgrain crops groundnut and cotton show a downward shift while all other crops show a positive shift.

MADHYA PRADESH

Appendix VII.2 (ii) shows yearwise trends in area under major crops in M.P. since 1968-69 while Table VII.4 shows the overall change between 1968-71 and 1983-86. Rice area shows

substantial increase over the period in the state, but the increase in wheat area is relatively small. Among coarse cereals maize area shows a clear increase and area under small millets a small increase. On the other hand area under jowar, bajra and maize shows a moderate decline. Unlike U.P. area under pulses has increased substantially in M.P. mainly on account of growth of gram area. The increase in area under rice, wheat, maize and pulses in M.P. is mainly due to expansion of the cropped area rather than due to diversion of area from other crops.

Among the foodgrain crops we find that area under oilseeds has increased substantially though area under groundnut has declined. Among the other commercial crops sugarcane and cotton area has declined but area under potato has increased.

In M.P. also nearly 80 percent area is devoted to foodgrains cultivation (Table VII.5). The cropping pattern of the state shows a fair degree of stability as changes in the percent area under different crops over the period are generally small. The most noticeable change is a clear decline in percent area under total cereals and the increase in percent area under non-foodgrain crops.

Table VII.2

Trends in Area Under Major Crops in U.P. - 1968-71 to 1983-86

Crop	Area in '000 ha.		Actual Change	Compound Growth Rate (% per annum)
	Average For			
	1968-71	1983-86		
Rice	4347	5482	+1135	1.55
Wheat	5474	8392	+2918	2.88
Jowar	763	645	- 118	-0.94
Bajra	1066	950	- 116	-0.70
Maize	1475	1165	- 310	-1.28
Barley	1431	590	- 841	-3.14
Small Millets	755	418	- 337	-2.51
<u>Total Cereals</u>	15084	17655	+2571	1.05
Gram	2168	1424	- 744	-1.97
Arhar	594	526	- 68	-0.70
<u>Total Pulses</u>	4122	2964	-1158	-1.66
<u>Total Foodgrains</u>	19206	20618	+1412	0.45
Total Oilseeds	663	840	+ 177	1.61
Ground Nut	346	181	- 165	-2.60
Rapeseed and Mustard	190	486	+ 296	6.44
Sugarcane	1308	1573	+ 265	1.28
Potato	163	310	+ 147	4.37
Cotton	50	26	- 24	-2.65
Other Crops	1446	1793	+ 437	
<u>Total Non-Foodgrains</u>	3630	4542	+ 912	
Total Cropped Area	22836	25160	+2324	

Source : Calculated from Bulletin of Agricultural Statistics, U.P.

Table VII.3Changes in the Cropping Pattern in U.P. - 1968-71 to 1983-88

Crop	Per Cent Area Under the		Actual Crop to Total Cropped Area Change
	1968-71	1983-88	
Rice	19.1	21.8	+2.7
Wheat	24.0	33.3	+9.3
Jowar	3.4	2.6	-0.8
Bajra	6.7	3.8	-2.9
Maize	6.5	4.6	-1.9
Barley	6.3	2.3	-4.0
Small Millets	3.3	1.7	-1.6
<u>Total Cereals</u>	66.1	70.2	+4.1
Gram	9.5	5.7	-3.8
Arhar	2.6	2.1	-0.5
<u>Total Pulses</u>	18.1	11.8	-6.3
<u>Total Foodgrains</u>	84.1	81.9	-2.2
Total Oilseeds	2.9	3.3	+0.4
Ground Nut	1.5	0.7	-0.8
Rapeseed and Mustard	0.8	1.9	+1.1
Sugarcane	3.7	6.3	+0.6
Potato	0.7	1.2	+0.5
Cotton	0.2	0.1	-0.1
Other Crops	6.3	7.1	+0.8
<u>Total Non-Foodgrains</u>	15.9	18.1	+2.2
Total Cropped Area	100.0	100.0	-

Source : Calculated from Bulletin of Agricultural Statistics, U.P.

Table VII.4

Trends in Area Under Major Crops in M.P. - 1968-71 to 1983-86

Crop	Area in '000 ha.		Actual Change	Compound Growth Rate (% per annum)
	Average For			
	1968-71	1983-86		
Rice	4391	4922	531	0.81
Wheat	3468	3648	180	0.38
Jowar	2136	2116	- 20	-0.08
Bajra	216	168	- 48	-1.54
Maize	606	816	210	2.34
Barley	172	155	- 17	-0.74
Small Millets	1415	1437	22	0.15
<u>Total Cereals</u>	12489	13109	620	0.30
Gram	1612	2184	572	2.34
Arhar	495	496	1	-
<u>Total Pulses</u>	4316	4952	636	-
<u>Total Foodgrains</u>	16805	18061	1256	0.52
Total Oilseeds	1914	2442	528	1.92
Ground Nut	453	320	- 133	-1.98
Rapeseed and Mustard	206	312	106	3.27
Sugarcane	60	45	- 15	-1.73
Potato	16	29	13	4.58
Cotton	686	547	-139	-1.41
Other Crops	776	1560	784	4.77
<u>Total Non-Foodgrains</u>	3452	4623	1171	1.97
<u>Total Cropped Area</u>	20257	22684	2427	

Source : Calculated from Bulletin of Agricultural Statistics, M.P.

Table VII.5Changes in the Cropping Pattern in M.P. - 1968-71 to 1983-88

Crop	Per Cent Area Under the Crop to Total Cropped Area		Actual Change
	1968-71	1983-88	
Rice	21.7	21.7	-
Wheat	17.1	16.1	-0.1
Jowar	10.5	9.3	-1.2
Bajra	1.1	0.7	-0.4
Maize	3.0	3.6	0.6
Barley	0.8	0.7	-0.1
Small Millets	7.0	6.3	-0.7
<u>Total Cereals</u>	61.7	57.8	-3.9
Gram	8.0	9.6	1.6
Arhar	2.4	2.2	-0.2
<u>Total Pulses</u>	21.3	21.8	0.5
<u>Total Foodgrains</u>	83.0	79.6	-3.4
Total Oilseeds	9.5	10.8	1.3
Ground Nut	2.2	1.4	-0.8
Rapeseed and Mustard	1.0	1.4	0.4
Sugarcane	0.3	0.2	-0.1
Potato	0.1	0.1	-
Cotton	3.4	2.4	-1.0
Other Crops	3.8	6.9	3.1
<u>Total Non-Foodgrains</u>	17.0	20.4	3.0
Total Cropped Area	100.0	100.0	-

Source : Calculated from Bulletin of Agricultural Statistics, M.P.

VII.4 Cropping Pattern at the District Level

Since a good deal of spatial variation in the cropping pattern exists in the Central Zone it is important to study the cropping pattern at the district level. Appendix VII.3(i) and VII.3(ii) show the proportion of gross cropped area under major crops and crop groups in U.P. and M.P. respectively. By and large cropping pattern in the entire zone is subsistence oriented with foodgrains as the dominant crop group. Thus in as many as 41 districts of U.P. and 24 districts of M.P. more than 80 per cent area is under foodgrains in a good many districts the figure exceeding 90 per cent (Table VII.6). In general, the dominance of foodgrains is greater in U.P. Hills, U.P. Tarai, Bundelkhand region of U.P. and M.P. and the eastern plateau of M.P. (Map VII.2).

Table VII.6

Distribution of Districts According to Per Cent of Gross Cropped Area Under Foodgrain Crops in Central Zone, 1983-86

		(Nos.)	
Percentage of Gross Cropped Area Under Foodgrains		U.P.	M.P.
Below	60.0	4	3
Between	60.0 and 70.0	2	8
Between	70.0 and 80.0	7	10
Between	80.0 and 90.0	25	16
Over	90.00	16	8
All Districts		54	45

The proportion of area under non-foodgrains is generally higher in the western parts of both the states. It would appear that the availability of irrigation is an important determinant of commercialization of agriculture.

Among foodgrains wheat and rice have the dominant share in majority of the districts in the Central Zone. In fact, in U.P. in as many as 37 districts wheat is the first crop and in the remaining 15 districts it is the second crop. Rice is the first crop in 10 districts and second crop in 23 districts in U.P. In M.P. wheat is the first crop in 17 districts and second crop in 6 districts, while rice is the first crop in 10 districts and second crop in 6 districts. Gram, Jowar and oilseeds also occupy important position in the cropping pattern in many districts in M.P.

The spatial distribution of wheat and rice growing districts in the Central Zone has been shown in Map VII.3 and VII.4 respectively.

Table VII.7

Distribution of Districts According to Per Cent of Gross Cropped Area Under Wheat and Rice in Central Zone, 1983-86

(Nos.)

Percent of Gross Cropped Area Under the Crop	Wheat		Rice	
	U.P.	M.P.	U.P.	M.P.
Below 5.0	-	8	8	21
Between 5.0 and 10	-	6	4	7
Between 10.0 and 20.0	-	11	12	2
Between 20.0 and 30.0	11	9	16	6
Between 30.0 and 40.0	41	7	12	-
40.0 and Above	2	4	2	9
All Districts	54	45	54	45

The phenomenal success of HYV wheat seeds has drastically changed the cropping pattern in U.P. in favour of wheat crop. Nearly in all districts of U.P. except the dry Bundelkhand part one-third or more of the gross cropped area in the district under wheat (Map VII.3 and Table VII.7). In M.P., however, where irrigation facilities are limited the number of districts specializing in wheat is relatively small, mainly in the central and western parts of the state.

Rice is again first or second main crop in a majority of U.P. districts. In general, the proportion of rice in gross sown area sharply increases as one moves from west to east and south to north (Map VII.4). In M.P. also it is the eastern districts which are specializing in rice cultivation mainly under rain fed conditions. But in the western parts much less area is devoted to rice cultivation.

On the basis of the proportion of area under first three major crops in a district we have identified five crop regions in U.P. and seven crop regions in M.P. Table VII.8 and VII.9 give details of the districts falling in each crop region in the two states respectively. In U.P. the most popular crop combination is wheat, rice and sugarcane. In M.P. the most popular crop combination consists of wheat, gram and oilseeds followed by rice, coarse grains and oilseeds. It will be observed that each crop combination generally consists of one or more spatial clusters of districts.

Table VII.8District Level Crop Combinations in U.P., Early 1980s

Crop Combinations	Districts
I. Wheat, Coarse Grains, Oilseeds	(3) Agra, Aligarh, Mathura
II. Wheat, Rice, Sugar-cane	(14) Bareilly, Bijnor, Moradabad, Muzaffarnagar, Pilibhit, Rampur, Saharanpur, Shahjahanpur, Lakhimpur, Kheri, Azamgarh, Basti, Deoria, Gorakhpur, Nainital
III. Wheat, Maize, Sugarcane	(3) Bulandshahr, Ghaziabad, Meerut
IV. Wheat, Coarse Grains, Rice	(21) Budaun, Etah, Etawah, Farrukhabad, Mainpuri, Hardoi, Kanpur, Lucknow, Rae Barel, Unnao, Gonda, Jaunpur, Mirzapur, Pratapgarh, Almora, Chamoli, Dehradun, Pithoragarh, Pauri Garhwal, Uttarakashi, Tehri Garhwal
V. Wheat, Gram, Rice	(11) Barabanki, Fatehpur, Sitapur, Allahabad, Bahraich, Ballia, Faizabad, Ghazipur, Sultanpur, Varanasi, Banda

Note : Figures in brackets show the number of districts.

Table VII.9District Level Crop Combinations in M.P., Early 1980s

Crop Combinations	Districts
I. Rice, Wheat, Oil-seeds, Coarse Grains (4)	Raipur, Panna, Seoni, Mandala
II. Rice, Coarse Grains, Oilseeds (9)	Durg, Rajnandgaon, Bastar, Sarguja, Raigarh, Balaghat, Shahdol, Shidhi, Bilaspur
III. Wheat, Rice, Gram (4)	Rewa, Jabalpur, Damoh, Satna.
IV. Wheat, Gram, Oilseeds (11)	Sagar, Chhatarpur, Bhind, Gwalior, Raisen, Shivpuri, Dhar, Sehore, Hushangabad, Indore, Narsinghpur
V. Wheat, Coarse Grains, Gram (5)	Guna, Datia, Bhopal, Vidisha, Tikamgarh
VI. Coarse Grains, Oil-seeds (6)	Shajapur, Betul, Rajnandgaon, Chindwara, Dewas, Morena
VII. Coarse Cereals, Gram (4)	Jhabua, Ujjain, Mandsaur, Ratlam.
VIII. Coarse Grains, Cotton (2)	Khargone, Khandwa

Note : Figures in brackets show the number of districts.

VII.5 District Level Shift in Cropping Pattern

Appendix VII.4 (i) and VII.4 (iv) show the districtwise shifts in percent area under major crops over the period 1968-71 and 1983-86 in U.P. and M.P. respectively, while Table VII.10 and VII.11 show these changes in a synoptic form.

In U.P. rice shows a positive shift in area in 41 districts, but a negative shift in 15 districts. The positive shift was more marked in the district in the central and eastern region of U.P., while negative shift was more pronounced in western region. Maize has registered a negative shift in almost all districts of U.P., but a positive shift in most of the hill districts. Wheat has

registered most significant positive shift in all but 3 districts, the shift being above 5 percent points in as many as 34 districts. The most notable gains were registered in eastern districts, the traditional rice growing region. The positive shifts in favour of wheat and rice crops have been mainly at the cost of coarse cereals and pulses, particularly gram. Percent area under oilseeds has increased in most of the district in central and eastern U.P. and Bundelkhand, but a number of districts in western and hill region show a decline in percent area under oilseeds. Sugarcane registered a negative shift in as many as 30 districts of the state and a positive shift in 19 districts, which was moderate except in a few western districts.

The pattern of shift in the cropping pattern has been on different lines in M.P. as compared to U.P. Rice shows a positive shift in area in 29 districts of M.P., but a moderate negative shift in 12 districts. Impact of the wheat revolution has been limited in this state with 20 districts experiencing a positive shift and 22 negative shift in percent area under wheat. Both maize and gram show positive gains in a majority of districts in M.P., but the pattern with respect to oilseeds has been somewhat mixed. Sugarcane, however, shows a negative shift in area in most of the districts.

Table VII.10

Distribution of Districts According to Shift in Per Cent Area Under Major Crops During 1968-71 and 1983-86 : Uttar Pradesh

Shift in Area Under the Crop	Rice	Maize	Wheat	Gram	Oil- seeds	Sugar- cane
<u>Negative Shift</u>	16	43	3	47	19	30
Upto 1 % Point	10	14	1	3	10	17
Between 1 & 3% Point	5	20	-	16	8	11
Above 3% Point	1	9	2	28	1	2
<u>Positive Shift</u>	40	10	53	4	33	19
Upto 1 % Point	6	9	3	3	21	11
Between 1 & 3% Point	11	1	10	-	8	3
Above 3 % Point	23	-	40	1	4	5
<u>No Shifts</u>	-	3	-	5	4	7
Total	56	56	56	56	56	56

Source : Based on Appendix VII.4(i)

Table VII.11

Distribution of Districts According to Shift in Per Cent Area Under Major Crops During 1968-71 and 1983-86 : Madhya Pradesh

Shift in Area Under the Crop	Rice	Maize	Wheat	Gram	Oil-seeds	Sugar-cane
<u>Negative Shift</u>	11	5	24	12	22	25
Upto 1 % Point	11	5	6	6	9	25
Between 1 & 3% Point	-	-	4	4	9	-
Above 3% Point	-	-	14	2	4	-
<u>Positive Shift</u>	31	29	19	30	22	5
Upto 1 % Point	16	21	6	5	2	5
Between 1 & 3% Point	7	6	3	9	6	-
Above 3 % Point	8	2	10	16	14	-
<u>No Shifts</u>	3	11	2	3	1	15
Total	45	45	45	45	45	45

Source : Based on Appendix VI.4(ii)

VII.6 Conclusion

The limits of extensive cultivation have been nearly reached in U.P., though there is still some possibility of expanding cultivated area in M.P. There is, however, good scope for raising the intensity of cropping in both the states - from the present level of about 146 to 165 - 175 in U.P. and from 117 to 125 - 130 in M.P., primarily through the expansion of the irrigated area.

Since there are considerable variations at the regional level in soil, rainfall, altitude, availability of water, etc. in both the states appropriate cropping pattern for each agro-climatic sub-zone have to be developed. A few general directions regarding the future cropping pattern may, however, be indicated. In particular the distortions that have been introduced in the wake of the green revolution, viz. the tendency towards decline in diversity of crops and the decline in area under coarse cereals and pulses, have to be corrected through appropriate policy interventions. It would be desirable to encourage greater diversification in cropping pattern in the zone and reducing the dependence on subsistence oriented foodgrain cultivation by bringing down area under foodgrains from around 80 per cent at present to 70 per cent in the near future.

In U.P. conditions are favourable for wheat and rice cultivation over the Gangetic plains, but further expansion

of area under these crops should be discouraged. There is a need, on the other hand, to expand area under pulses which witnessed a marked decline in area in the post green revolution period. Similarly larger area should be brought under the cultivation of commercial crops like sugarcane, rapeseed and mustard, potato, vegetables, fruits and fodder crops. There is also scope for encouraging cultivation of cotton in some parts.

In M.P., bulk of area under cultivation will remain under rainfed farming. Hence, there is a need to discourage expansion of area under water intensive crops like wheat and sugarcane. The state will remain a major coarse cereal and pulse producing region of the country. Among the commercial crops suitable for the state are oilseeds, cotton and citrus fruits.

Since average allocation to different crops is primarily an individual decision, the government will have to adopt an appropriate set of financial and other incentives to persuade the farmers to adopt the desirable cropping pattern. Agricultural price policy has to be so devised as to maintain the relative profitability of the preferred crops. In addition steps should be taken for strengthening of the procurement system and giving infrastructural support in terms of input supply, credit, etc. for the cultivation of the preferred crops, area under which needs to be expanded. Agricultural research and extension system have similarly to be geared up giving due emphasis on developing high yielding

and quick maturing varieties of pulses, oilseeds and other crops cultivation of which needs to be encouraged. Finally, promotion of agro-processing industries in the rural areas and small towns would help in diversifying agriculture, while generating larger employment as well.

Appendix VII.1(i)Districtwise Cropping Intensity in Uttar Pradesh

Districts	1968-71	1983-86	Change in % Points
Agra	122.4	134.4	12.0
Aligarh	149.5	165.4	15.9
Bareilly	131.9	150.1	18.3
Bijnor	126.8	137.8	11.0
Budaun	124.5	141.8	17.3
Bulandshahr	149.1	172.7	23.7
Etah	141.5	160.6	19.1
Etawah	132.8	145.3	12.5
Farrukhabad	131.6	149.3	17.7
Ghaziabad	NA	167.8	-
Meerut	NA	164.1	-
Mainpuri	137.4	152.6	15.2
Mathura	128.4	140.1	11.7
Moradabad	130.1	152.9	22.8
Muzaffarnagar	142.8	160.0	17.1
Pilibhit	138.5	164.9	26.3
Rampur	142.6	162.3	19.6
Shahjahanpur	129.8	147.9	18.1
Shaharanpur	144.6	162.0	17.4
Barabanki	140.2	160.3	20.1
Fatehpur	121.8	135.5	13.8
Hardoi	129.7	140.0	10.3
Kanpur	121.2	136.4	15.3
Lakhimpur Kheri	128.7	139.3	10.6
Lucknow	131.4	138.0	6.6
Rae Bareli	134.2	149.7	15.4
Sitapur	127.3	137.7	10.4
Unnao	133.6	143.7	10.1

contd....

Appendix VII.1(i) contd....

Allahabad	126.5	137.8	11.3
Azamgarh	126.2	149.3	23.0
Bahraich	134.9	150.7	15.8
Ballia	131.8	149.5	17.6
Basti	137.0	150.7	13.7
Deoria	141.9	151.1	9.2
Faizabad	138.6	154.8	16.2
Ghazipur	127.1	142.1	14.9
Gonda	140.2	158.7	18.5
Gorakhpur	140.5	148.1	7.7
Jaunpur	130.1	151.6	21.5
Mirzapur	125.4	140.6	15.2
Pratapgarh	125.1	146.3	21.3
Sultanpur	130.6	146.5	16.0
Varanasi	135.1	149.2	14.1
Almora	164.5	161.4	- 3.1
Chamoli	155.7	153.4	- 2.3
Dehradun	146.3	156.4	10.1
Nainital	157.2	170.6	13.4
Pithoragarh	158.0	175.4	17.5
Pauri Garhwal	164.2	151.2	-12.9
Tehri Garhwal	160.0	159.1	- 0.9
Uttar Kashi	124.3	150.5	26.1
Banda	117.9	117.7	- 0.2
Hamirpur	103.4	105.7	2.3
Jalaun	105.0	106.3	1.3
Jhansi	NA	111.9	-
Lalitpur	NA	126.9	-
UTTAR PRADESH	131.5	145.8	14.3

Source : Calculated from Bulletin of Agricultural Statistics,
Uttar Pradesh

Appendix VII.1(ii)Districtwise Cropping Intensity in Madhya Pradesh

Districts	1968-71	1983-86	Change in % Points
Raipur	127	133	6
Durg	131	141	10
Rajnandgaon	NA	127	-
Bastar	105	104	-1
Bilaspur	121	127	6
Sarguja	112	114	2
Raigarh	107	107	-
Jabalpur	116	119	3
Balaghat	135	131	-4
Chindwara	106	117	11
Seoni	107	110	3
Mandla	117	121	4
Narsinghpur	103	109	6
Sagar	103	107	4
Damoh	108	110	2
Panna	109	113	4
Tikamgarh	123	132	9
Chhatarpur	112	115	3
Rewa	117	129	12
Shidhi	125	130	5
Satna	116	121	5
Shahdol	110	115	5
Indore	107	128	21
Dhar	109	110	1
Jhabua	108	113	5
Khargone	106	109	3
Khandwa	103	108	5
Ujjain	106	123	17
Mandsaur	114	142	28
Ratlam	110	129	19
Dewas	103	117	14
Shajapur	106	119	13
Morena	109	110	1
Bhind	102	105	3
Gwalior	106	108	2
Shivpuri	109	114	5
Guna	103	105	2
Datia	102	105	3
Bhopal	NA	111	-
Sehore	102	116	14
Raisen	101	108	7
Vidisha	102	104	2
Betul	108	117	9
Rajgarh	106	115	9
Hushangabad	101	120	19
MADHYA PRADESH	111	117	6

Source: Calculated from Bulletin of Agricultural Statistics, MP

Appendix VII.2(i)

Area Under Major Crops in U.P. - 1968-69 to 1985-86

(in '000 ha.)

Year	Rice	Wheat	Juar	Baj- ra	Maize	Bar- ley	Small Millet	Total Cere- als	Gram	Arhar	Total pulses	Total Food- grains	Total Food- grains	Total Food- grains	Total Oil- seeds	Ground- nut	Rap- seed & Mustard	Sugar- cane	Potato	Cotton
1968-69	4261	5067	826	1056	1426	1491	783	14910	2188	622	4006	8512	10398	18916	629	358	166	1203	174	48
1969-70	4362	5450	728	1021	1492	1479	760	15292	2249	579	3956	8582	10722	12948	661	339	194	1377	155	51
1970-71	4418	5907	734	1121	1508	1323	722	15633	2078	582	3725	8671	10782	19458	697	341	212	1345	162	52
1971-72	4722	6045	621	949	1479	1312	677	15805	1989	468	3525	8608	10717	19330	719	328	273	1274	179	56
1972-73	4374	6135	729	1086	1483	1288	726	15822	1921	564	3507	8564	10761	19329	662	315	221	1308	172	47
1973-74	4471	6009	704	1063	1483	1268	687	15685	1956	527	3477	8590	10568	19162	724	353	240	1473	187	42
1974-75	4425	6152	718	999	1377	1232	602	15504	1721	540	3149	8290	10360	18654	915	415	341	1492	205	27
1975-76	4622	6302	710	1008	1396	1202	572	15811	1726	529	3155	8473	10491	18967	883	425	293	1441	191	29
1976-77	4653	6624	703	1013	1323	1075	660	16070	1659	531	3048	8503	10590	19118	808	389	270	1456	183	23
1977-78	4867	6760	674	982	1193	963	619	16077	1656	521	2989	8504	10542	19066	838	329	353	1636	202	27
1978-79	5147	7390	658	930	1177	869	602	16792	1641	501	3104	8707	11080	19895	782	324	306	1634	277	31
1979-80	5057	7532	680	1043	1154	786	514	16781	1554	542	2942	8688	10946	19723	574	246	227	1373	242	41
1980-81	5291	8112	678	995	1224	779	514	17610	1496	523	2849	8921	11410	20469	709	190	408	1363	266	41
1981-82	5389	7772	686	975	1174	686	477	17173	1571	515	3047	8948	11130	20220	858	261	460	1652	288	30
1982-83	5064	8296	564	954	1084	627	441	17043	1506	480	2979	8313	11545	20022	839	299	408	1783	271	35
1983-84	5352	8528	645	1040	1106	608	447	17745	1358	518	2832	8797	11591	20578	1086	233	348	1788	299	30
1984-85	5506	8389	659	946	1173	567	423	17663	1374	520	2888	8892	11478	20551	883	185	517	1543	321	20
1985-86	5587	8281	630	864	1209	593	391	17555	1502	543	3171	8901	11644	20726	864	124	567	1490	299	28

Source : Bulletin of Agriculture Statistics, U.P.

Appendix VII.2(ii)

Area Under Major Crops in M.P. - 1968-69 to 1985-86

(in '000 ha.)

Year	Rice	Wheat	Juar	Bajra	Maize	Barley	Small Millet	Total Cereals	Gram	Arhar	Total pulses	Total kharif Food-grains	Total Rabi Food-grains	Total Food-grains	Total Oil-seeds	Ground-nut	Rapeseeds & Mustard	Sugar-cane	Potato	Cotton
1968-69	4312	3011	2374	242	590	167	1548	12406	1495	484	3910	10526	5790	16316	1839	496	157	56	18	688
1969-70	4353	3348	2309	232	581	188	1537	12733	1540	487	4011	10545	6199	16744	1796	460	183	67	15	684
1970-71	4383	3403	2178	222	591	157	1516	12608	1619	500	4255	10422	6441	16863	1926	464	204	61	16	691
1971-72	4525	3665	1965	198	597	173	1449	12727	1681	504	4352	10270	6809	17079	2069	489	234	52	16	706
1972-73	4579	3277	2225	224	624	180	1439	12697	1625	529	4361	10692	6365	17057	1906	436	212	57	18	683
1973-74	4544	3273	2037	219	624	191	1467	12512	1851	516	4771	10533	6750	17263	2162	439	236	67	19	600
1974-75	4526	2728	2105	181	657	211	1488	12119	1842	514	4418	10648	5889	16537	2184	448	264	81	20	612
1975-76	4588	3361	1980	198	649	204	1507	12653	1917	517	4760	10594	6819	17413	2141	492	242	77	19	637
1976-77	4635	3144	1890	194	678	159	1473	12361	2017	509	4702	10578	6485	17063	1970	521	180	76	19	606
1977-78	4733	3554	1944	167	697	177	1456	12895	1780	488	4561	10656	6800	17436	2085	437	253	91	20	683
1978-79	4821	3778	1865	177	702	187	1407	13095	1738	475	4542	10609	7028	17637	2150	410	239	48	24	675
1979-80	4770	3085	2148	174	751	219	1302	12607	2174	512	4669	10847	6429	17276	1753	320	185	36	21	614
1980-81	4860	3365	2352	199	779	198	1311	13221	1807	523	4583	11233	6571	17804	1809	296	236	33	31	595
1981-82	4850	3306	2252	174	788	181	1318	13025	2029	533	4863	11086	6802	17886	2046	300	291	38	28	614
1982-83	4863	3553	2034	171	794	166	1301	13080	2387	496	5319	10842	7377	18219	2198	349	278	43	27	560
1983-84	4946	3780	2128	174	831	159	1311	13486	2106	508	4982	11124	7344	18468	2961	312	312	43	29	544
1984-85	4957	3598	1909	162	850	142	1259	13023	2076	493	4844	10825	7044	17867	2769	302	355	37	30	525
1985-86	5032	3705	1934	165	839	144	1406	13251	2282	480	5149	10932	7468	18400	2845	257	338	73	27	536
1986-87	5041	3502	1897	166	850	136	1333	12940	2218	437	4775	10780	6935	17715	2746	244	331	82	28	523

Source : Agricultural Statistics, Madhya Pradesh

Appendix VII.3(i)

Districtwise Per Cent Area Under Major Crops : U.P., 1983-84

Districts	Wheat	Rice	Coarse Cereals	Pulses	Total Food- grains	Sugar Cane	Oilseeds
Agra	28.7	0.5	31.2	12.8	73.2	0.4	16.0
Aligarh	34.1	2.3	31.6	13.6	81.6	2.2	5.7
Bareilly	32.8	27.1	9.0	7.7	76.6	8.1	4.6
Bijnor	28.5	17.5	1.0	3.0	50.0	29.8	3.3
Budaun	37.5	8.0	28.3	8.9	82.7	3.1	6.3
Bulandshahr	37.3	1.4	29.9	4.3	72.9	8.8	2.7
Etah	35.3	5.7	30.4	13.7	85.1	1.5	4.0
Etawah	28.6	17.5	24.5	15.1	85.7	1.3	5.6
Farrukhabad	31.5	8.2	28.6	8.2	76.5	2.2	4.2
Ghaziabad	34.9	2.6	18.7	4.0	60.2	9.7	1.1
Meerut	32.6	3.4	6.9	2.4	45.3	48.6	0.8
Mainpuri	36.4	14.4	26.6	7.4	84.8	0.5	4.6
Mathura	40.8	1.2	24.3	8.0	74.3	3.1	9.7
Moradabad	36.7	14.5	13.1	2.2	66.5	17.0	2.0
Muzaffarnagar	30.3	8.5	3.1	2.3	44.2	33.6	0.7
Pilibhit	37.7	37.4	1.1	4.8	81.0	8.2	3.3
Rampur	35.9	28.7	8.9	3.8	77.3	8.0	2.1
Saharanpur	31.3	15.8	5.2	2.4	54.7	21.2	2.9
Shahjahanpur	40.2	28.5	6.3	9.0	84.0	5.2	3.2
Barabanki	33.0	36.6	6.3	11.1	87.0	2.9	1.5
Fatehpur	29.4	23.5	17.3	20.9	91.1	1.9	2.3
Hardoi	38.9	16.9	17.5	11.4	84.7	3.0	6.4
Kanpur	30.4	16.3	19.4	20.4	86.5	1.2	5.9
Lakhimpur Kheri	30.0	28.3	5.5	7.1	70.9	16.4	6.1
Lucknow	35.7	25.6	11.1	11.6	84.0	0.5	1.4
Rae Bareli	36.7	33.7	10.0	12.9	93.3	1.1	1.7
Sitapur	34.2	25.2	11.3	10.5	81.2	8.1	4.8
Unnao	38.2	22.8	19.8	10.5	89.3	0.9	3.8

Contd.....

Appendix VII.3(i) Contd....

Allahabad	31.0	25.6	18.8	17.4	92.8	0.8	1.5
Azamgarh	35.0	37.8	7.4	9.1	89.3	6.3	0.1
Bahraich	28.6	34.3	16.7	13.1	92.7	1.1	3.9
Ballia	32.3	29.2	13.3	13.8	88.6	4.0	0.2
Basti	33.5	44.4	6.5	7.4	91.8	3.4	1.2
Deoria	36.2	37.2	5.5	4.4	83.3	10.5	1.2
Faizabad	36.7	38.5	3.6	10.1	88.9	4.4	0.4
Ghazipur	34.4	28.9	11.5	12.3	87.1	4.2	0.2
Gonda	31.2	36.7	11.5	11.4	90.8	3.8	2.9
Gorakhpur	38.6	41.2	4.4	6.5	90.7	3.2	1.9
Jaunpur	36.9	26.9	17.1	8.4	89.3	4.1	0.3
Mirzapur	24.2	28.8	20.6	13.7	87.3	0.8	6.7
Pratapgarh	35.5	31.6	11.8	13.8	92.7	0.9	0.5
Sultanpur	29.7	35.9	8.7	13.9	88.2	1.8	0.4
Varanasi	32.2	31.2	12.3	11.9	87.6	2.7	1.0
Alomora	33.9	19.8	40.1	1.6	95.4	-	0.3
Chamoli	31.7	25.9	31.7	0.5	89.8	-	0.4
Dehradun	32.6	17.5	23.5	3.5	77.1	6.0	2.8
Nainital	35.5	32.3	5.8	2.6	76.2	10.0	2.9
Pithoragarh	33.1	25.9	30.4	5.0	92.4	0.1	0.2
Pauri Garhwal	29.7	17.5	47.4	2.0	96.6	-	0.5
Tehri Garhwal	33.6	14.0	43.8	2.3	93.7	-	1.2
Uttar Kashi	31.4	21.7	25.2	2.1	80.4	-	2.2
Banda	29.1	14.1	18.2	35.5	96.9	0.1	1.8
Hamirpur	28.9	0.8	18.6	43.5	91.8	0.4	6.4
Jalaun	25.5	0.9	14.8	50.3	91.5	0.6	6.2
Jhansi	30.6	1.1	17.6	43.2	92.5	-	5.1
Lalitpur	31.5	5.2	27.1	24.5	88.3	0.2	7.4
UTTAR PRADESH	33.4	21.8	15.0	11.8	82.0	6.3	3.3

Source : Calculated from the Bulletin of Agricultural Statistics, U.P.

Appendix VII.3(ii)

Districtwise Per Cent Area Under Major Crops : M.P., 1983-86

Districts	Wheat	Rice	Coarse Cereals	Pulses	Total Food-grains	Sugar Cane	Oilseeds
Raipur	1.6	65.6	4.7	21.5	93.4	-	5.2
Durg	2.7	46.6	11.0	34.1	94.4	-	6.8
Rajnandgaon	3.1	42.7	17.4	24.9	88.1	-	10.6
Bastar	0.3	63.4	20.1	10.1	93.9	0.1	5.0
Bilaspur	2.1	64.1	6.1	20.7	93.0	0.1	4.8
Sarguja	2.6	49.4	24.8	10.5	87.3	0.1	11.1
Raigarh	0.6	68.4	8.5	12.1	89.6	0.1	8.4
Jabalpur	32.6	24.1	11.1	23.5	91.7	-	6.2
Balaghat	5.4	64.3	6.6	12.3	88.6	0.8	9.6
Chindwara	14.8	4.7	35.4	21.8	76.7	0.7	17.6
Seoni	20.1	23.0	22.5	17.9	83.5	0.1	14.6
Mandla	16.5	27.2	31.6	9.4	84.7	0.2	14.3
Narsinghpur	13.0	5.1	9.8	59.7	87.6	0.6	9.3
Sagar	48.1	2.8	4.3	22.5	80.7	-	8.6
Damoh	32.5	16.6	9.6	29.8	88.5	-	7.6
Panna	34.7	21.8	13.6	16.9	87.0	0.7	13.3
Tikamgarh	28.5	9.9	25.4	15.7	79.5	0.3	6.9
Chhatarpur	29.0	5.5	20.2	24.4	79.1	0.1	9.0
Rewa	30.7	26.7	16.3	18.7	92.4	-	6.4
Shidhi	10.3	19.8	40.4	18.2	88.7	-	10.4
Satna	42.9	20.2	13.0	15.2	91.3	-	7.4
Shahdol	11.0	41.6	25.9	9.4	88.1	-	11.5
Indore	22.0	0.1	17.9	22.3	62.3	0.7	23.8
Dhar	12.0	1.7	26.4	26.2	66.3	0.2	15.7
Jhabua	2.6	7.2	41.5	34.4	85.7	-	6.4
Khargone	5.1	2.5	36.3	18.9	62.8	0.2	8.4
Khandwa	5.3	6.5	28.4	18.9	59.1	0.2	5.7
Ujjain	12.2	0.1	32.4	25.6	70.3	0.4	16.3
Mandsaur	8.6	0.1	32.0	34.7	75.3	0.1	8.3
Ratlam	8.7	1.1	29.3	33.6	72.7	0.3	5.0
Dewas	13.0	0.5	29.0	15.1	57.6	1.0	15.3
Shajapur	11.2	0.7	33.8	19.5	65.2	0.3	18.0
Morena	233.4	0.5	22.4	15.3	61.6	0.7	34.3
Bhind	25.6	3.0	20.8	35.0	84.4	-	13.3
Gwalior	33.9	8.1	12.7	25.5	80.2	1.1	13.8
Shivpuri	25.2	2.4	24.1	20.0	71.7	0.2	12.5
Guna	29.8	0.4	30.0	24.8	85.0	0.1	6.7
Datia	30.8	0.9	17.2	39.0	87.9	0.5	8.8
Bhopal	44.2	0.9	13.0	22.6	80.7	0.5	7.6
Sehore	28.7	1.1	14.3	22.7	66.8	0.5	16.0
Raisen	36.7	1.4	3.8	39.5	81.4	-	12.8
Vidisha	46.7	0.3	3.2	32.6	82.8	0.1	5.1
Betul	14.5	7.0	38.7	19.0	79.2	0.5	12.5
Rajgarh	9.9	1.3	34.5	22.6	68.3	0.3	12.5
Hushangabad	28.5	2.4	11.6	20.5	63.3	-	28.5
MADHYA PRADESH	14.6	19.7	24.1	22.3	80.7	0.2	10.9

Source : Calculated from Bulletin of Agricultural Statistics, MP

Appendix VII.4(i)

District Level Shifts in the Cropping Pattern in U.P. Between 1968-71 and 1983-86

Districts	Shift in % Area Under the Crop % Points					
	Rice	Maize	Wheat	Gram	Oilseeds	Sugarcane
Agra	-0.1	-0.9	1.7	-8.3	11.4	-0.8
Aligarh	-0.5	-4.6	3.4	-3.0	5.3	-1.3
Bareilly	3.7	-2.1	7.2	-6.8	-1.5	-1.0
Bijnor	-5.5	-2.3	1.8	-5.5	-0.8	11.2
Budaun	1.4	-1.0	7.5	-3.5	-2.9	-1.6
Bulandshahr	-0.7	2.9	2.2	-3.5	2.4	0.5
Etah	0.3	-3.6	7.1	-2.8	-0.4	-0.8
Etawah	3.0	-2.5	4.7	-2.6	1.6	-0.5
Farrukhabad	1.8	0.5	3.7	-3.8	-1.5	0.1
Ghaziabad	-1.9	-0.9	3.5	-3.2	1.0	2.8
Meerut	-1.4	-1.6	1.9	-3.3	0.8	17.0
Mainpuri	1.8	-3.3	7.9	-4.8	1.1	-0.6
Mathura	-0.1	-1.6	6.4	-6.3	8.4	-1.5
Moradabad	0.2	-1.8	2.8	-3.7	-2.5	7.2
Muzaffarnagar	-0.8	-2.7	-0.4	-2.8	0.6	7.2
Pilibhit	5.2	-1.3	11.1	-6.4	0.7	-5.1
Rampur	9.2	-7.8	7.4	-8.1	-	0.7
Saharanpur	-0.8	-2.4	2.5	-4.3	0.6	4.7
Shahjahanpur	8.9	-1.2	12.5	-6.2	-1.0	-2.5
Barabanki	7.3	-1.4	11.3	-10.5	0.4	-1.8
Fatehpur	4.8	-0.1	15.9	-5.9	1.1	-0.3
Hardoi	5.6	-0.6	14.9	-7.4	-5.2	-0.8
Kanpur	3.9	-0.5	9.0	-4.3	0.6	0.1
Lakhimpur Kheri	7.1	-6.2	7.5	-5.6	-	1.7
Lucknow	6.3	-2.6	9.7	-5.5	2.7	-1.2
Rae Bareli	5.7	-0.2	19.1	-2.3	-	0.4
Sitapur	8.6	-4.2	9.0	-7.5	-1.8	1.5
Unnao	4.6	-1.0	15.9	-3.0	-0.9	-0.9

Contd.....

Appendix VII.4(i) Contd....

Allahabad	3.2	-0.2	17.1	-2.4	-0.6	0.1
Azamgarh	1.4	-1.5	28.0	0.5	0.1	-0.6
Bahraich	8.5	-10.7	6.1	-2.2	-0.2	0.3
Ballia	5.3	-3.0	21.5	-3.8	0.1	-2.0
Basti	3.5	-1.2	10.3	0.8	0.4	-0.7
Deoria	7.8	-2.4	11.4	-0.5	0.7	-1.5
Faizabad	5.4	-1.3	15.5	-3.9	0.3	-1.7
Ghazipur	1.9	-1.5	25.4	-2.7	-	-0.1
Gonda	3.3	-5.1	10.3	-1.1	0.8	0.3
Gorakhpur	2.1	-1.1	14.5	-0.2	0.4	-0.8
Jaunpur	3.9	-3.3	25.7	-1.1	0.3	-0.5
Mirzapur	0.9	-0.8	12.2	-1.3	1.6	-0.1
Pratapgarh	4.7	-0.1	25.9	-2.2	0.3	-0.4
Sultanpur	2.4	-0.2	16.3	-3.0	0.3	-0.4
Varanasi	-0.7	-1.1	23.0	-1.9	0.4	-1.3
Almora	0.5	0.4	0.1	-	-0.4	-
Chamoli	-0.1	0.2	0.5	-	-1.3	-
Dehradun	1.9	0.5	4.7	-0.8	1.0	-1.1
Nainital	17.6	-0.8	7.9	-2.8	-2.8	-3.5
Pithoragarh	-2.9	-0.4	-3.2	-	-0.2	0.1
Pauri Garhwal	-2.8	1.0	3.4	0.1	-1.4	-
Tehri Garhwal	1.9	0.4	1.7	-	-0.7	-
Uttar Kashi	1.3	0.4	1.2	-	-0.8	-
Banda	0.1	-	8.7	-7.9	0.1	-
Hamirpur	-0.5	-	1.9	-6.6	0.5	0.1
Jalaun	-1.6	0.4	-3.9	-12.4	3.5	0.1
Jhansi	-0.5	-	1.6	-6.5	2.6	-
Lalitpur	0.1	0.5	0.3	7.6	1.3	-0.2
UTTAR PRADESH	2.7	-1.8	9.3	3.0	0.4	0.5

Appendix VII.4(ii)
District Level Shifts in the Cropping Pattern in M.P. Between
1968-71 and 1983-86

Districts	Shift in % Area Under the Crop % Points					
	Rice	Maize	Wheat	Gram	Oilseeds	Sugarcane
Raipur	2.7	-	0.7	-	-1.3	-0.1
Durg	18.5	-0.1	0.6	2.9	2.4	-0.1
Rajnandgaon	4.1	0.4	-0.4	2.7	-0.9	-
Bastar	3.6	-0.2	-	-	-0.4	-0.1
Bilaspur	3.8	0.0	0.1	2.4	-0.7	-0.2
Sarguja	1.9	0.7	1.4	-0.1	0.9	-
Raigarh	4.8	-0.1	0.3	-	-0.8	-0.2
Jabalpur	0.8	0.3	4.7	-1.9	-0.5	-0.1
Balaghat	5.0	0.1	0.4	-0.1	-3.0	0.3
Chindwara	1.0	2.3	2.0	-2.4	3.2	0.2
Seoni	1.7	0.3	-2.1	-0.2	1.1	-0.1
Mandla	3.0	0.8	4.5	-0.8	-0.8	-
Narsinghpur	0.1	-	-3.8	9.7	4.9	-
Sagar	-	-	-3.1	5.2	1.8	-
Damoh	0.3	-	-10.5	7.6	-	-
Panna	1.0	0.2	7.7	-2.5	-3.9	-0.2
Tikamgarh	0.1	0.3	-	0.5	0.2	-0.3
Chhatarpur	0.4	-	3.8	2.1	-1.8	-0.1
Rewa	4.6	-0.1	7.3	0.2	-4.8	-
Shidhi	2.2	0.6	3.6	0.2	-2.0	-
Satna	0.8	-	12.0	-3.3	-3.6	-
Shahdol	4.6	1.1	3.8	-0.9	-1.6	-
Indore	-0.1	0.7	-7.5	2.0	18.6	-0.5

contd.,...

Appendix VII.4(ii) (contd....)

Dhar	-0.3	2.5	-3.2	1.1	1.9	-0.1
Jhabua	0.4	-0.7	1.5	2.0	-2.1	-
Khargone	0.3	1.3	-0.3	0.6	-2.3	-
Khandwa	0.4	0.1	0.2	0.4	-1.0	-
Ujjain	-0.1	1.5	-9.0	7.8	10.4	-0.1
Mandsaur	-0.1	7.2	-1.9	13.7	-4.1	-0.2
Ratlam	-0.2	4.5	-5.5	8.8	-1.9	-0.5
Dewas	-0.3	0.7	-5.4	3.7	9.0	0.3
Shajapur	-0.5	0.9	-6.4	8.9	9.8	-0.3
Morena	-0.2	-	6.0	9.7	13.3	0.1
Bhind	0.7	-	4.8	9.3	1.2	-0.1
Gwalior	1.5	-	-1.0	-4.0	4.7	-0.2
Shivpuri	-0.2	0.5	-0.3	2.7	2.3	-0.5
Guna	-	1.0	0.9	7.3	-1.5	-0.1
Datia	-0.1	0.2	-5.4	-0.1	-0.3	0.3
Bhopal	0.3	0.1	-0.6	7.0	5.0	-0.4
Sehore	-	0.3	-2.1	7.5	12.6	-0.3
Raisen	-	-	-6.9	3.5	7.1	-
Vidisha	0.1	0.1	-3.8	7.2	-0.7	-0.1
Betul	1.0	0.6	-0.5	-3.0	8.0	-0.2
Rajgarh	-0.1	1.5	-3.0	5.3	4.6	-0.1
Hushangabad	0.1	-	-5.1	1.5	16.5	-
MADHYA PRADESH	1.2	0.8	-	2.2	1.9	-0.1

CHAPTER VIII

Irrigation And Water Resources

VIII.1 Interaction Between Land and Water Resources

Planning for land use has to be properly integrated with the planning for other natural resources particularly water. Land and water resources are interrelated in a dynamic natural setting. The problem of deforestation, soil erosion, sedimentation of reservoirs, floods, water logging, soil salinity, etc. are closely correlated. Expansion of irrigation facilities is essential for raising land productivity and increasing the intensity of land use, which are so essential for raising the supply of food and fodder. Irrigation projects by storing excess flow of monsoon water also help in flood control. At the same time our large and medium irrigation projects have led to the problem of water logging and increase in salinity and alkalinity on a large scale.

Again the large scale deforestation and the consequent destruction of the soil cover over higher ranges has aggravated the problem of soil erosion, creating further problems of sedimentation of reservoirs and river beds and aggravating the problem of floods.

The soil profile serves as a medium for storage and percolation of water and replenishes surface and ground water. In the dry and arid zones particularly special

emphasis has to be placed on water harvesting and conservation of soil moisture for raising crop yields.

In short neither land nor water resources can be planned in isolation. It is only by maintaining the proper balance between the land and water regimes that we can hope for a sustainable process of development. To attain this we have to move in the direction of an integrated strategy of land and water resource development and management as argued earlier.

In the present chapter we have discussed the trends and sources of irrigation and the availability of surface and ground water resources and the extent of their utilization. A strategy for the management and development of the water resources has also been suggested

VIII.2 Demand for Water Resources

With the acceleration in the pace of development and increase in population the demand for water resources is likely to shoot up rapidly both for agricultural and non-agricultural uses, including industrial and domestic purposes. According to the National Commission on Agriculture, 1976 the demand for non-agricultural purposes which was only 8 per cent of total water utilization in 1973-74 is likely to go upto as much as 27 per cent by the year 2025 AD. Over the period the demand for water was expected to increase by 120 per cent for irrigation purposes (from 35 M ham to 77 M ham), by 833 per cent for other purposes (from 3 M ham to 28 M ham) and by 176 per cent for all uses (from 38

M ham to 105 M ham)¹.

Similarly one would expect a significant step up in the demand for water in the Central Zone. According to one study the demand for water is expected to increase by 350 per cent between 1968 and 2000 in U.P. (from 4 M ham to 18 M ham) and by 300 per cent in Madhya Pradesh (from 1.5 M ham to 6 M ham).² Thus considerable intensification of use of water is expected in the coming years which underscores the need for efficient and proper management and utilization of our water resources.

VIII.3 Irrigation Trends and Sources

VIII.3.1 Growth in Net and Gross Irrigated Area

Expansion of irrigation facilities has been a key element in the strategy of agricultural development in the country. The State Governments have invested huge sums in major and medium irrigation projects and deep tubewells. Investment in private tubewells and pumpsets has particularly picked up with the introduction of the new agricultural technology in the mid-sixties. Government subsidy and institutional finance also played an important role in the development of ground water resources. As a result there has been a tremendous increase in net and gross irrigated area, which can be seen from Table VIII.1(i) and VIII(ii).

Net irrigated area has increased from 48.09 lakh ha. to

1. Government of India, National Commission on Agriculture, 1976, pp.9-10.

2. M.C. Chaturvedi, Water : Second India Studies, MacMillan India, Delhi, 1976, p.51.

101.32 lakh ha. in U.P. and from 8.90 lakh ha. to 29.87 lakh ha. in M.P. over the period 1950-51 and 1985-86. The increase comes to 110.7 per cent in U.P. and 235.6 per cent in M.P. Similarly gross irrigated area shows a jump of 149.2 per cent and 241.2 per cent in the two states respectively. However, the rates of increase in irrigated area have been fluctuating from one period to another and were generally slower in the pre-green revolution period.

Table VIII.1(i)

Trends in Net and Gross Irrigated Area in U.P. :
1950-51 to 1985-86

Year	Net Irrigated Area		Gross Irrigated Area		Irrigation Intensity (4/2 X 100)
	Actual ('000 ha)	As % of NSA	Actual ('000 ha)	As % of GSA	
1950-51	4809	29.7	5179	25.9	107.7
1955-56	4921 (2.3)	29.2	5326 (2.8)	25.4	108.2
1960-61	5044 (2.5)	29.2	5528 (3.8)	25.0	109.6
1965-66	5845 (15.9)	33.7	6577 (19.0)	29.8	112.5
1970-71	7160 (22.5)	41.4	8304 (26.3)	35.8	116.0
1975-76	7933 (10.8)	46.1	9231 (40.0)	40.0	116.4
1980-81	9453 (21.2)	54.9	11371 (23.2)	46.3	120.3
1985-86	10132 (7.18)	58.9	12908 (13.5)	51.0	127.4

Source : Bulletin of Agricultural Statistics, U.P.

Note : Figures in brackets show percent increase in irrigated area over the preceding period.

Table VIII.1(ii)Trends in Net and Gross Irrigated Area in M.P. :
1950-51 to 1985-86

Year	Net Irrigated Area		Gross Irrigated Area		Irrigation Intensity (4/2 X 100)
	Actual ('000 ha)	As % of NSA	Actual ('000 ha)	As % of GSA	
1950-51	890	6.4	905	5.9	101.7
1955-56	825 (-7.3)	5.3	837 (-7.5)	4.8	101.5
1960-61	924 (12.0)	5.7	938 (12.1)	5.2	101.5
1965-66	976 (5.6)	5.9	1000 (6.6)	5.6	102.5
1970-71	1481 (51.7)	8.1	1523 (52.3)	7.4	102.8
1975-76	1804 (21.8)	9.6	1896 (24.5)	8.9	105.1
1980-81	2332 (29.3)	12.5	2453 (29.4)	11.5	105.2
1985-86	2987 (28.1)	15.4	3088 (25.9)	13.4	103.4

Source : Bulletin of Agricultural Statistics, M.P.

Note : Figures in brackets show percent increase in irrigated area over the preceding period.

The coverage of irrigation facilities has also jumped up significantly over the period. Thus net irrigated area as per cent of net sown area has gone up from 29.7 per cent to 58.9 per cent between 1950-51 and 1985-86 in U.P., while as proportion of gross sown area it has gone up from 25.9 per cent to 51.0 per cent. The coverage of irrigated area is markedly lower in M.P. as compared to U.P. being hardly around 15 per cent of cropped area, though there has been a distinct improvement over the planning period. Thus, while more than 50 per cent of cropped area in U.P. is under

conditions of assured irrigation, agriculture in M.P. remains basically under rainfed conditions.

VIII.3.2 Irrigation Sources

Table VIII.2 (i) and VIII.2 (ii) show the growth of irrigated area by source since 1950-51 in U.P. and M.P. respectively. Over time there has taken place a striking change in the related importance of different sources of irrigation in both the states. Thus, in U.P. the proportion of net area irrigated by canals has come down from 38.4 per cent in 1950-51 to 33.1 per cent in 1985-86, while the proportion of area irrigated by tubewells has increased dramatically from 5.8 per cent to 56.9 per cent over this period. Dug wells and other sources which used to be the major sources of irrigation at the beginning of the planning period have now become of marginal significance in the state.

Table VIII.2(i)

Growth of Irrigated Area by Sources in U.P. :
1950-51 and 1985-86

('000 ha)

Year	Canals	Tubewells	Other Wells	Other Sources	Net Irrigated Area
1950-51	1847(38.4)	276(5.8)	1905(39.6)	781(16.2)	4809(100.0)
1955-56	1736(35.3)	333(6.8)	2068(42.0)	783(15.9)	4921(100.0)
1960-61	1993(39.5)	543(10.8)	1844(36.6)	664(13.2)	5044(100.0)
1965-66	2292(39.2)	906(15.5)	1999(34.2)	647(11.1)	5845(100.0)
1970-71	2498(34.9)	2330(32.6)	1703(23.8)	628(8.8)	7160(100.0)
1975-76	2743(34.6)	3189(40.2)	1314(16.6)	687(8.7)	7934(100.0)
1980-81	3178(33.6)	5053(53.5)	745(7.9)	475(5.0)	9453(100.0)
1985-86	3357(33.1)	5768(56.9)	565(5.6)	443(4.4)	10132(100.0)

Source : Bulletin of Agricultural Statistics, U.P. (Annual)

Note : Figures in brackets show percent to net irrigated Area.

Table VIII.2(ii)Growth of Irrigated Area by Sources in M.P. :
1950-51 and 1985-86

('000 ha)

Year	Canals	Tubewells	Other Wells	Other Sources	Net Irrigated Area
1950-51	354(39.8)	235(26.4)	249(27.9)	52(5.8)	890 (100.0)
1955-56	370(44.9)	119(14.4)	298(36.1)	38(4.6)	825 (100.0)
1960-61	441(47.7)	122(13.2)	324(35.1)	37(4.0)	924 (100.0)
1965-66	461(47.2)	118(12.1)	345(35.4)	52(5.3)	976 (100.0)
1970-71	710(47.9)	130(8.8)	551(37.2)	90(6.1)	1481 (100.0)
1975-76	801(44.4)	132(7.3)	726(40.2)	145(8.0)	1804 (100.0)
1980-81	1035(44.4)	136(5.8)	986(42.3)	175(7.5)	2332 (100.0)
1985-86	1296(43.4)	145(4.9)	1297(43.4)	249(8.3)	2987 (100.0)

Source : Bulletin of Agricultural Statistics, M.P. (Annual)

Note : Figures in brackets show percent to net irrigated Area.

In M.P. the relative importance of both canals and wells has increased over time. Both the sources now account for 43.4 per cent of irrigated area each. Reliance on tanks for irrigation has, however, declined from 26.4 per cent in 1950-51 to only 4.9 per cent in 1985-86. The relative importance of tubewells is lower in M.P. as compared to U.P., where the terrain is suitable for shallow tubewells. Thus there were only 11,374 tubewells in M.P. in 1984-85 against a figure of 7,05,440 in U.P. Thus not only the coverage of irrigation in M. P. is very low, the sources of irrigation in the state are relatively less regular and assured.

VIII.3.3 Cropwise Irrigated Area

Cultivators display strong cropwise and seasonwise preference in use of irrigation water. Rabi irrigation accounts for nearly 70 per cent of total irrigated area. In U.P. wheat accounts of 55.1 per cent, paddy for 14.4 per cent and sugarcane for 9.4 per cent of irrigated area (Table VIII.3(i)). Again in U.P. cultivation of wheat and sugarcane is largely under irrigated conditions, but only one-third area of paddy receives irrigation. Irrigation is applied to a very limited extent in case of coarse cereals and pulses. Among oilseeds groundnut cultivation is essentially under non-irrigated conditions, but nearly 60 per cent of area under rapeseed and mustard is irrigated (Table VIII.3(ii)).

Table VIII.3(i)

Cropwise Irrigated Area in U.P. : 1970-71 and 1985-86

Crop	% of Irrigated Area Under the Crop		Share of Irrigated Area Under the Crop in Total Irrigated Area	
	1970-71	1985-86	1970-71	1985-86
Paddy	16.9	33.2	8.9	14.4
Maize	16.6	22.3	3.0	2.1
Wheat	67.5	86.2	47.6	55.1
Barley	55.7	48.1	8.8	2.2
Gram	20.8	17.1	5.2	2.0
Arhar	0.2	6.7	0.01	0.3
Rapeseed & Mustard	30.7	59.0	0.8	2.7
Sugarcane	67.1	81.3	10.8	9.4
Other Crops	21.3	25.5	14.9	11.8
All Crops/Irrigated Area	36.0	51.0	100.0	100.0

Source : Bulletin of Agricultural Statistics, U.P.

Table VIII.3(ii)Cropwise Irrigated Area in M.P. : 1970-71 and 1985-86

Crop	% of Irrigated Area Under the Crop		Share of Irrigated Area Under the Crop in Total Irrigated Area	
	1970-71	1985-86	1970-71	1985-86
Paddy	14.1	17.9	40.7	29.2
Maize	0.3	0.7	0.1	0.2
Wheat	15.3	36.5	34.2	43.8
Barley	27.5	23.6	2.8	1.1
Gram	6.0	13.2	6.4	9.8
Sugarcane	93.4	97.3	3.7	2.3
Other Crops	1.8	3.9	12.1	13.8
All Crops/Irrigated Area	7.4	13.4	100.0	100.0

Source : Bulletin of Agricultural Statistics, M.P.

In M.P. also nearly 70 per cent of irrigation is accounted for by wheat and paddy crops. However, cropwise coverage is relatively more limited except in the case of sugarcane, which is grown essentially under irrigated conditions. Only 36.5 per cent of area under wheat and 17.9 per cent area under paddy receives irrigation in the state (Table VIII.3(ii)). Thus, lack of assured irrigation facilities is the major obstacle in raising agricultural productivity in Madhya Pradesh.

VIII.4 Districtwise Irrigated Area

Appendix VIII.1(i) and VIII.1(ii) show the proportion of net and gross area irrigated to net and gross area sown in U.P. and M.P. respectively, while Table VIII.4 show the distribution of districts according to the range of net and gross irrigated area respectively. Map VIII.1 and VIII.2 depict the same information cartographically.

Table VIII.4

Distribution of Districts According to Percentage of Net Area Irrigated to Net Area Sown in Central Zone, 1983-86
(Nos.)

Percent of Net Irrigated Area to Net Sown Area	U.P.	M.P.
Below 5.0	-	7
Between 5.0 - 10.0	4	10
Between 10.1 - 20.0	3	15
Between 20.1 - 40.0	8	10
Between 40.1 - 60.0	8	3
Between 60.1 - 80.0	25	-
Above 80.0	8	-
All Districts	56	45

Very marked differences are found to exist in the irrigation facilities across districts. In U.P. irrigation facilities are more extensively developed. As many as 33 districts have over 60 per cent of net sown area under irrigation, while in another 8 districts between 40.0 to 60.0 per cent of net sown area is irrigated. However, 15

districts have limited irrigation facilities. These mostly fall in the Hill Region and Bundelkhand. Eastern and Western Gangetic plain divisions have relatively better irrigation facilities. In a group of north western districts, which is agriculturally most prosperous, over 80 per cent of net area sown is under irrigated conditions.

In M.P. irrigation facilities are generally inadequately developed, though considerable variations across districts are observed. Thus as many as 32 districts have less than 20 per cent of net sown area under irrigation; in 10 districts between 20 and 40 per cent of net sown area is irrigated; and in 3 districts between 40 and 60 per cent of net sown area is irrigated. A group of districts in the northern part consisting of Bhind, Morena, Gwalior, Datia, Shivpuri, Tikamgarh and Chattarpur has relatively better developed irrigation facilities.

Similar spatial patterns in irrigation facilities are observed with respect to irrigated area as percent of gross cultivated area as can be seen from Appendix VIII.1(i) and VIII.1(ii), Table VIII.5 and Map VIII.2.

Tubewells and pumpsets are among the most assured means of irrigation required for intensive agriculture. Map VIII.3 and Appendix VIII.2(i) and VIII.2(ii) show the districtwise position with respect to tubewells and pumpsets in U.P. and M.P. In U.P. the Hill region is not suitable for boring tubewells at all, while in Bundelkhand also their number is limited because of rocky terrain. However, the entire U.P. plains are dotted with numerous tubewells and pumpsets with

their number exceeding more than 100 per 1000 hectare of net sown area. Districts in the north-west U.P. have the highest number of ground water installations.

Table VIII.5

Distribution of Districts According to Percentage of Gross Area Irrigated to Gross Area Sown in Central Zone, 1983-84
(Nos.)

Percent of Gross Irrigated Area to Gross Sown Area	U.P.	M.P.
Below 15.0	5	31
Between 15.0 & 30.0	7	10
Between 30.0 & 45.0	10	4
Between 45.0 & 60.0	17	-
Between 60.0 & 75.0	13	-
Above 75.0	4	-
All Districts	56	45

Madhya Pradesh, however, does not present a suitable environment for ground water irrigation due to rocky terrain and low water table. Tubewell installations are therefore rare in most of the districts of the state. A few installations are, however, found in some districts along the Narmada and Chambal basins.

VIII.5 Irrigation Potential

Among the two states comprising the Central Zone, U.P. is well endowed with surface and ground water resources but M.P. is not so fortunate in this respect. However, in both the states a considerable part of the total water resources

is yet to be exploited. The estimates of irrigation potential have been revised upwards from time to time. Thus, the Irrigation Commission, 1972 estimated the irrigation potential in U.P. at 151 lakh hectares, but the National Commission on Agriculture, 1976 put it at 240 lakh hectares, while current estimate put the figure at a level of 257 lakh hectares (Table VIII.6). Similarly the estimates of irrigation potential range from 80 lakh hectares to 102 lakh hectares in case of M.P. (Table VIII.7).

Table VIII.6

Estimated Irrigation Potential in U.P.
(in lakh hectares)

Source	Irrigation Commission 1972	National Commission on Agricul- culture, 1976	Ministry of Agriculture, Govt. of India
1. Major & Medium Projects	76	110	125
2. Minor Projects	75	130	132
(a) Surface Water	10	N.A.	N.A.
(b) Ground Water	65	130	N.A.
3. Total	151	240	257
4. As % of Gross Cropped Area	N.A.	84	N.A.

- Source : 1. Report of the Irrigation Commission, 1972,
Government of India, New Delhi, Vol.I, pp.218-219
2. Report of the National Commission on Agriculture,
1976, Part I, Resource Development, Government of
India, New Delhi, pp.44-45
3. Indian Agriculture in Brief, 21st Edition,
Ministry of Agriculture, Government of India, New
Delhi.

Table VIII.7**Estimated Irrigation Potential in M.P.**
(in lakh hectares)

Source	Irrigation Commission 1972	National Commission on Agricul- culture, 1976	Ministry of Agriculture, Govt. of India
1. Major & Medium Projects	56	61	60
2. Minor Projects	24	30	42
(a) Surface Water	8	N.A.	N.A.
(b) Ground Water	16	30	42
3. Total	80	91	102
4. As % of Gross Cropped Area	N.A.	32	N.A.

- Source : 1. Report of the Irrigation Commission, 1972,
Government of India, New Delhi, Vol.I, pp.218-219
2. Report of the National Commission on Agriculture,
1976, Part I, Resource Development, Government of
India, New Delhi, pp.44-45.
3. Indian Agriculture in Brief, 21st Edition,
Ministry of Agriculture, Government of India, New
Delhi.

According to the Report of the National Commission, on Agriculture, 1976 with the full exploitation of irrigation potential by 2025 about 84 per cent of gross cropped area can be covered by irrigation facilities in U.P. though in M.P. the proportion would be only 32 per cent. Against this 49.1 per cent of gross cropped area is U.P. and only 12.4 per cent area in M.P. was receiving irrigation in the early 1980s. Thus, there is considerable scope for expanding irrigation facilities in both the states.

In U.P. the surface and ground water resources account for roughly half of the ultimate irrigation potential each. However, in M.P. major reliance will have to be placed on surface water resources which account for nearly 60 per cent of the irrigation potential. The picture with respect to the surface and ground water is examined in greater details in the following sections.

VIII.6 Surface Water Resources

A brief account of the river systems in the Central Zone has been given in Chapter I. Presently the ultimate irrigation potential of major and medium schemes is estimated at 125 lakh hectares in U.P. and 60 lakh hectares in M.P., which comes to 21.4 per cent and 10.3 per cent of total irrigation potential of the country respectively. However, till 1984-85 exploited surface water potential amounted to only 54.5 lakh hectares and 30.0 lakh hectares in U.P. and M.P. respectively as shown in Table VIII.8. Even when we take into account the target of the additional irrigation potential to be created during the Seventh Plan, 40.2 per cent of irrigation potential in U.P. and 63.7 per cent of irrigation potential in M.P. still remains unexploited. Moreover, there is a considerable gap between the created and the utilized potential in both the states.

VIII.7 Ground Water Resources

As discussed in Chapter I the state of U.P. has abundant supply of ground water resources, which is generally available in most parts of the state at a shallow depth of

Table VIII.8Benefits From Major and Medium Irrigation Schemes Till
1984-85 in Central Zone

(Lakh Hectares)

Item	U.P.	M.P.
1. Ultimate Irrigation Potential	125.0	60.0
2. Irrigation Potential Created by the end of 1984-85	68.1	18.0
3. Irrigation Potential Utilized by the end of 1984-85	55.1	13.1
4. Potential Created As Per Cent of Ultimate Irrigation Potential	54.5	30.0
5. Potential Utilization As Per Cent of Potential Created	80.9	72.8
6. Target of Additional Benefit During Seventh Plan	6.7	3.8
7. Likely Unexploited Potential at the end of Seventh Plan	50.2	38.2
8. Unexploited Potential As Per Cent of Ultimate Potential at the end of Seventh Plan	40.2	63.7

Source : Indian Agriculture in Brief, 21st Edition,
Ministry of Agriculture, Government of India.

4 - 5 metres. In M.P., however, availability of water is relatively restricted and its tapping is not so easy in the alluvial tracts of U.P. (Map VIII.4). As shown in Table VIII.6 and VIII.7 the irrigation potential of minor irrigation schemes is put currently at about 130 lakh hectares in U.P. and between 30 and 40 lakh hectares in M.P., which is around one-third and one-tenth of the country's total potential from minor schemes respectively. According

to the Ministry of Agriculture sources nearly 94 per cent of potential of minor schemes has been utilized in U.P., but in M.P. over one-third potential of these schemes is yet to be exploited (Table VIII.9).

Table VIII.9

Benefits From Minor and Medium Irrigation Schemes Till
1984-85 in Central Zone

(Lakh Hectares)

Item	U.P.	M.P.
1. Ultimate Irrigation Potential	132.0	42.0
2. Irrigation Potential Created by the end of 1984-85	119.9	19.9
3. Irrigation Potential Utilized by the end of 1984-85	109.8	18.7
4. Potential Created As Per Cent of Ultimate Irrigation Potential	90.8	47.4
5. Potential Utilization As Per Cent of Potential Created	91.6	94.0
6. Target of Additional Benefit During Seventh Plan	3.6	7.0
7. Likely Unexploited Potential at the end of Seventh Plan	8.5	15.1
8. Unexploited Potential As Per Cent of Ultimate Potential at the end of Seventh Plan	6.4	36.0

Source : Indian Agriculture in Brief, 21st Edition,
Ministry of Agriculture, Government of India.

The recent exercise of the Ministry of Water Resources indicate a large unexploited potential of ground water resources in the Central Zone. Thus, the present stage of ground water resource development according to these studies

is only 29 per cent in U.P. and 8 per cent in M.P. (Table VIII.10). Studies done by the State Level Ground Water Organizations also reveal more or less a similar picture.

Table VIII.10

Ground Water Resource Potential in Central Zone

(M Ham)

Item	U.P.	M.P.
1. Utilizable Resource	9.27	5.95
2. Net Draft	2.68	0.49
3. Potential Available For Future Development	6.58	5.46
4. Stage of Ground Water Development (%)	28.96	8.20

Source : Ministry of Water Resources, Government of India,
Ground Water Development of India, 1986

There is clearly a vast potential for developing the ground water resources for irrigation and other purposes in the Central Zone. Only 22 out of 819 blocks in U.P. and 7 blocks in M.P. are identified as dark areas where the state of development is likely to reach 85 per cent or more in the near future. With the intensification of the use of ground water resources in the wake of the green revolution the average water table has receded in a number of districts in the Central Zone, but the situation is far from alarming as of now (Map VIII.5).

Table VIII.11Estimated Number of Feasible Tubewells and Additional Potential of Irrigated Area in Central Zone

Item	U.P.	M.P.
1. Net Recharge (MCM), 1985	78349	50760
2. Net Draft (MCM), 1985	25709	5836
3. Balance Unutilized (MCM), 1985	52640	44924
4. Additional Number of Tubewells Feasible (in lakhs)	23.92	6.61
5. Additional Potential of Irrigation (lakh hectares)	119.62	99.15
6. Additional Potential as Per Cent of Net Sown Area	69.35	51.61
7. Per Cent of Net Irrigated to Net Sown Area in 1983-84	58.87	14.43

Note : Number of Feasible Tubewells have been calculated on the assumption of annual ground water draft of 0.022 MCM per tubewell and area irrigated per tubewell has been calculated at 5 hectare per tubewell in U.P. For M.P. annual ground water draft per tubewell has been taken at 0.068 MCM and area irrigated per tubewell has been taken at 15 hectares.

A rough estimate has been worked out by us about the additional feasible tubewells and the potential of irrigated area by them if the present unutilized balance of 52640 MCM in U.P. and 44924 MCM in M.P. is to be fully exploited. The exercise indicates that an irrigation potential of nearly 120 lakh hectares in U.P. and 99 lakh hectares in M.P. can be created by tapping the ground water balance, which comes to about 70 per cent and 50 per cent of present net sown area in the two states respectively.

Districtwise details of stage of ground water development, ground water balance, additional feasible tubewells and irrigation potential have been given in Appendix VIII.3(i) and VIII.3(ii). Wide variations are to be observed in the stage of ground water development at the district level. As shown in Table VIII.12 less than 15 per cent of ground water is exploited in 4 districts of U.P. and 26 districts of M.P. In 23 districts of U.P. and 15 districts of M.P. between 15 and 35 per cent of ground water is being utilized. Thus in 23 districts of U.P. and 4 districts of M.P. more than 35 per cent of ground water is being utilized. Relatively higher level of ground water development has taken place in Western U.P. and some districts of Eastern U.P., while in M.P. higher stage of development is observed in south western parts (Map VIII.6).

Table VIII.12

Distribution of Districts According to Stage of Ground Water Development in Central Zone, 1985

(Nos.)

Range	U.P.	M.P.
Below 5.0	1	6
5.0 - 15.0	3	20
15.1 - 25.0	7	6
25.1 - 35.0	16	9
35.1 - 45.0	16	2
45.1 and Above	7	2
All Districts	50*	45

*Excludes 6 districts of U.P. Hills.

Districtwise details of ground water availability and additional irrigation potential have been given in Appendix VIII.3(i) and VIII.3(ii). If the balance of ground water resource is effectively exploited it would make a very sizeable difference in the coverage of irrigation facilities, though the extent of benefit would vary from district to district.

VIII.8 Strategy of Water Resource Development

Increase in human and livestock population is putting increasingly greater pressure on land and water resources. Future development of agriculture as well as industry will be increasingly constrained by the availability of water. Hence the need for proper husbanding, development and management of our water resources cannot be overemphasized. Some of the critical areas from the point of view of the strategy for development and management of water resources, particularly in the context of the Central Zone, are being highlighted below.

- (i) There is a need for a more systematic assessment of the water resources and the demand for water for different purposes on a regional and sub-regional basis.
- (ii) As emphasized by the Irrigation Commission as well as the National Commission on Agriculture comprehensive river basin plans have to be prepared. For this purpose River Basin Commissions should be set up with adequate powers.
- (iii) In U.P., which is a water abundant region, the objective should be to maximize land productivity through intensive use.

of water. But in a water scarce state like M.P. emphasis has to be on an extensive use of water and protective irrigation. Special emphasis has to be put on water harvesting and conservation of soil moisture, through simple labour intensive methods like contour bunds. Renovation of 50,000 and odd old tanks and other structures in M.P. should be taken up on a priority basis.

(iv) Over the next decade, the strategy should be rapid exploitation of the ground water resources, which are more quick yielding and economical and for which large unexploited potential is available in the Central Zone. Action plan should be drawn for creating ground water potential of 10 lakh hectares per year in each of the state. Modern technology like remote sensing techniques can be very helpful in location of potential ground water aquifers in the dry zones of M.P. and Bundelkhand region of U.P. Liberal credit assistance to small and marginal farmers and promotion of community and government tubewells are needed for more equitable sharing of ground water resources.

(v) Simultaneously efforts at the exploitation of surface water resources for irrigation purposes and generation of hydel power have to continue. Execution of on-going projects has to be streamlined to avoid the time and cost overruns and the operational efficiency of the existing works has to be improved. For removal of inter-state disparities in irrigation facilities, it would be necessary to transfer water from the river basins with water surplus to river basins

with water deficit.

Technical possibilities for such inter basin water transfers have been indicated by hydrology experts. Thus, surplus water of Brahmaputra can be transferred through Ganga and Son rivers to Narmada,¹ which has a large storage potential. Efforts should be made to move towards a national water grid after a thorough study of the technological, economic, ecological and organizational considerations involved.²

(vi) Efficiency of water use has to be improved and wastage of water to be avoided by adopting scientific water management techniques, such as, lining of canals and channels, proper maintenance of field channels, chemical and biological methods to reduce evaporation losses, levelling of fields, adoption of sprinkle and drip irrigation, promoting optimum cropping patterns, rationalization of water tariffs, etc.

(vii) Measures for dealing with problems of water logging have to be taken up as an integral part of water management as problems of water logging and salination has emerged on a sizeable scale due to spread of canal irrigation, faulty drainage, etc. To deal with the problem of water logging conjunctive measures like use of surface and ground water

1. K.L.Rao, India's Water Wealth, Orient Longmans, New Delhi 1976.

2. M.C. Chaturvedi and Peter Rogers (eds.), Water Resources Systems Planingg : Some Case Studies for India, Indian Academy of Sciences, Bangalore, 1985.

resources, proper drainage system, attention to proper alignment of road and rail network, etc. have to be adopted.

(viii) Finally, as argued by us earlier the planning for the development of water resources has to be carried out within the framework of an integrated land and water resource plan. This would require a high degree of coordination among various concerned departments particularly those dealing with major and minor irrigation, agriculture, forest and public works and doing away with the highly departmentalized approach in existence today.

Appendix VIII.1(i)Districtwise Net and Gross Irrigated Area in U.P., 1968-71
and 1983-86

District	Net Irrigated Area As % of Net Area Sown		Actual Change	Gross Irrigated Area As % of Gross Cropped Area		Actual Change
	1968-71	1983-86		1968-71	1983-86	
Agra	44.4	65.8	21.3	38.4	52.2	13.8
Aligarh	79.9	93.3	12.1	66.5	72.7	6.2
Bareilly	35.7	61.4	25.7	32.7	46.9	14.3
Bijnor	35.9	61.2	25.3	32.5	55.7	23.2
Budaun	37.3	59.7	22.4	32.8	45.7	12.9
Bulandshahr	77.2	96.7	19.5	68.7	86.9	18.2
Etah	59.0	82.4	23.4	50.0	60.7	10.8
Etawah	51.1	68.4	17.3	44.5	61.4	16.9
Farrukhabad	44.5	67.1	22.5	39.4	52.5	13.2
Ghaziabad	1					
Meerut	182.1	93.9	11.8	79.2	90.1	10.9
Mainpuri	65.5	83.7	18.3	53.4	64.9	11.5
Mathura	63.0	84.0	21.0	54.6	67.8	13.2
Moradabad	45.6	79.4	33.8	40.8	65.4	24.6
Muzaffarnagar	76.6	88.2	11.6	72.7	81.2	8.5
Pilibhit	30.6	78.0	47.4	27.1	67.1	40.0
Rampur	25.8	73.2	47.4	23.4	62.9	39.5
Saharanpur	49.4	73.5	24.0	45.2	66.7	21.6
Shahjahanpur	29.9	62.3	36.4	28.6	62.8	34.2
Barabanki	36.1	63.2	27.2	30.1	51.4	21.3
Fatehpur	30.1	47.1	17.0	27.3	44.8	17.5
Hardoi	25.0	57.5	32.5	20.5	46.1	25.6
Kanpur	34.1	54.9	20.8	31.6	51.7	20.1
Lakhimpur Kheri	13.3	38.6	25.4	10.8	33.6	22.8
Lucknow	38.3	62.4	21.1	34.6	56.8	22.3
Rae Bareli	45.9	68.0	22.1	40.4	65.0	24.6
Sitapur	21.7	38.5	16.8	17.6	31.9	14.4
Unnao	35.8	64.2	28.3	31.0	58.3	27.2

Contd....

Appendix VIII.1(i) (contd....)

Allahabad	27.0	47.1	20.0	24.1	42.1	18.0
Azamgarh	51.9	70.4	18.5	42.7	53.3	10.6
Bahraich	10.6	35.4	24.8	7.9	14.4	6.5
Ballia	41.3	60.1	18.8	33.3	46.0	12.7
Basti	52.9	61.2	8.4	38.6	41.1	2.5
Deoria	44.5	62.4	17.9	35.6	49.9	14.3
Faizabad	56.7	69.6	13.0	4.5	54.6	9.2
Ghazipur	38.5	65.1	26.7	34.2	55.6	21.4
Gonda	26.1	41.7	15.6	20.5	27.2	6.7
Gorakhpur	45.5	63.7	18.2	33.5	44.3	10.8
Jaunpur	54.3	69.3	14.9	44.1	52.0	8.0
Mirzapur	25.2	35.6	10.4	21.9	34.4	12.5
Pratapgarh	39.3	61.7	22.4	33.7	47.1	13.5
Sultanpur	40.3	54.7	14.4	31.7	40.3	8.6
Varanasi	47.1	70.6	23.4	39.1	62.8	23.7
Almora	N.A.	9.7	N.A.	N.A.	11.3	-
Chamoli	N.A.	6.1	N.A.	N.A.	7.4	-
Dehradun	31.2	41.5	10.3	32.9	39.6	6.6
Nainital	37.0	72.1	-	32.4	8.1	-
Pithoragarh	N.A.	7.9	-	N.A.	-	-
Pauri Garhwal	N.A.	8.6	-	N.A.	10.8	-
Tehri Garhwal	N.A.	14.7	-	N.A.	17.8	-
Uttar Kashi	N.A.	16.5	-	N.A.	18.6	-
Banda	16.8	25.2	8.4	16.0	24.2	8.2
Hamirpur	15.5	17.7	2.3	15.1	16.8	1.7
Jalaun	34.5	24.1	-10.4	34.3	23.2	-11.1
Jhansi	1					
Lalitpur	121.4	33.4	12.1	19.8	28.9	9.2
UTTAR PRADESH	40.5	58.3	17.8	34.8	49.9	15.1

Source : Calculated from Bulletin of Agricultural Statistics,
Uttar Pradesh

32.4
 46.1
 21.3

Appendix VIII.1(ii)Districtwise Net and Gross Irrigated Area in M.P., 1968-71
and 1983-86

District	Net Irrigated Area As % of Net Area Sown		Actual Change	Gross Irrigated Area As % of Gross Cropped Area		Actual Change
	1968-71	1983-86		1968-71	1983-86	
Raipur	23.4	35.2	11.8	18.6	26.7	8.1
Durg	18.7	29.6	10.9	17.1	21.8	4.7
Rajnandgaon	6.1	9.8	3.7	3.9	8.1	4.2
Bastar	1.9	1.8	-0.1	1.8	1.7	-0.1
Bilaspur	15.5	19.9	4.4	12.8	16.4	3.6
Sarguja	1.0	3.1	2.1	0.9	3.0	2.1
Raigarh	2.7	4.7	2.0	2.6	4.7	2.1
Jabalpur	3.7	7.9	4.2	3.8	7.8	4.0
Balaghat	37.7	41.7	4.0	28.1	34.5	6.4
Chindwara	4.5	12.4	7.9	4.3	10.6	6.3
Seoni	7.0	7.2	0.2	6.6	7.1	0.5
Mandla	0.7	1.9	1.2	0.6	2.0	1.4
Narsinghpur	3.3	11.0	7.7	3.4	10.2	6.8
Sagar	2.0	7.3	3.7	2.1	6.9	4.8
Damoh	3.1	5.7	2.6	4.3	6.5	2.2
Panna	3.5	7.4	3.9	3.4	7.1	3.7
Tikamgarh	33.0	44.9	11.9	27.6	35.5	7.9
Chhatarpur	19.5	27.5	8.0	17.7	24.0	6.3
Rewa	1.2	8.5	7.3	1.1	6.6	5.5
Shidhi	0.6	4.8	4.2	0.5	3.7	3.2
Satna	1.8	6.7	4.9	1.6	5.6	4.0

Annexure VIII.1(ii)(contd....)

Shahdol	0.8	2.4	1.6	0.8	2.1	1.3
Indore	5.8	23.6	17.8	6.3	18.9	12.6
Dhar	5.8	12.6	6.8	5.0	11.5	6.5
Jhabua	2.3	5.6	3.3	2.2	5.6	2.9
Khargone	5.8	14.1	8.3	5.5	12.9	7.4
Khandwa	4.2	10.4	6.2	4.2	10.9	6.7
Ujjain	2.8	14.9	12.1	2.9	12.3	9.4
Mandsaur	11.6	22.7	11.1	10.9	16.4	5.5
Ratlam	6.7	14.7	8.0	6.4	11.7	5.3
Dewas	2.7	15.8	13.1	2.7	13.6	10.9
Shajapur	5.4	15.5	10.1	5.4	13.2	7.8
Morena	20.1	44.5	24.4	18.6	40.7	22.1
Bhind	12.7	25.8	13.1	13.1	27.0	13.9
Gwalior	27.7	35.4	7.7	28.4	38.4	10.0
Shivpuri	16.7	23.1	6.4	13.8	20.7	6.9
Guna	3.0	6.5	3.5	3.0	6.3	3.3
Datia	9.1	22.7	13.6	8.9	22.1	13.2
Bhopal	4.6	12.9	8.3	4.4	11.6	7.2
Sehore	3.6	13.5	9.9	3.5	11.6	8.1
Raisen	1.3	10.7	9.4	1.3	9.9	8.6
Vidisha	0.5	4.3	3.8	0.4	4.2	3.8
Betul	7.3	13.0	5.7	6.9	11.2	4.3
Rajgarh	4.6	11.7	7.1	4.5	10.3	5.8
Hushangabad	2.0	30.2	28.2	2.0	25.1	23.1
MADHYA PRADESH	7.7	15.1	7.4	7.2	13.3	6.1

Source : Calculated from Bulletin of Agricultural Statistics, Madhya Pradesh (Annual)

Appendix VIII.2(i)Number of Tubewells and Pumpsets Per 1000 Hectare of Net
Sown Area in Uttar Pradesh, 1984-85

Districts	No. of Tubewells & Pumpsets per 1000 hectare of NSA
Agra	181
Aligarh	127
Bareilly	87
Bijnor	145
Budaun	80
Bulandshahr	152
Etah	103
Etawah	89
Farrukhabad	149
Ghaziabad	1
Meerut	1
Mainpuri	163
Mathura	137
Moradabad	109
Muzaffarnagar	186
Pilibhit	160
Rampur	122
Saharanpur	139
Shahjahanpur	163
Barabanki	142
Fatehpur	121
Hardoi	65
Kanpur	97
Lakhimpur Kheri	88
Lucknow	107
Rae Bareli	143
Sitapur	136
Unnao	86
	131

Contd.....

Appendix VIII.2(i) (contd....)

Allahabad	59
Azamgarh	123
Bahraich	63
Ballia	91
Basti	117
Deoria	97
Faizabad	140
Ghazipur	102
Gonda	119
Gorakhpur	123
Jaunpur	146
Mirzapur	27
Pratapgarh	117
Sultanpur	95
Varanasi	86
Almora	Nil
Chamoli	Nil
Dehradun	14
Nainital	107
Pithoragarh	Nil
Pauri Garhwal	Nil
Tehri Garhwal	Nil
Uttar Kashi	Nil
Banda	22
Hamirpur	19
Jalaun	15
Jhansi	35
UTTAR PRADESH	101

Source : Calculated from Bulletin of Agricultural Statistics,
Uttar Pradesh

Appendix VIII.2(ii)Number of Tubewells and Pumpsets Per 1000 Hectare of Net
Sown Area in Madhya Pradesh, 1984-85

Districts	No. of Tubewells & Pumpsets per 1000 hectare of NSA
Raipur	1
Durg	1
Rajnandgaon	-
Bastar	-
Bilaspur	-
Sarguja	-
Raigarh	-
Jabalpur	1
Balaghat	-
Chhindwara	-
Seoni	-
Mandla	-
Narsinghpur	3
Sagar	-
Damoh	-
Panna	-
Tikamgarh	-
Chhatarpur	-
Rewa	-
Shidhi	-
Satna	-
Shahdol	-

Contd....

Appendix VIII.2(ii) (contd.....)

Indore	4
Dhar	7
Jhabua	-
Khargone	-
Khandwa	-
Ujjain	1
Mandsaur	-
Ratlam	1
Dewas	2
Shajapur	-
Morena	1
Bhind	-
Gwalior	1
Shivpuri	-
Guna	-
Datia	-
Bhopal	2
Sehore	1
Raisen	1
Vidisha	-
Betul	-
Rajgarh	-
MADHYA PRADESH	1

Source : Calculated from Bulletin of Agricultural Statistics,
Madhya Pradesh (Annual)

Appendix VIII.3(i)

**Districtwise Ground Water Resources of U.P. (1985) and
Number of Feasible Ground Water Structures**

Districts	Annual Utiliz- able Recharge (MCM)	Net Annual Draft (MCM)	Ground Water Balance (MCM)	Stage of Ground Water Develo- pment (%)	Addit- ional No. of Feasi- ble Tube- Wells ('000)	Addit- ional Area Irriga- ted by Addit- ional Tube- wells ('000 ha)	Addit- ional Area Irrig- ated As % of Net Sown Area
Agra	1003.2	613.4	309.8	61.1	14.1	70.4	20.4
Aligarh	1451.5	841.9	609.6	58.8	28.7	139.5	35.5
Bareilly	1410.4	387.9	1022.5	27.5	46.5	232.4	70.2
Bijnor	1483.1	609.0	874.9	41.1	40.8	199.8	57.8
Budaun	1152.3	572.4	579.9	49.7	26.4	132.8	32.5
Bulandshahr	1655.2	593.2	1062.0	35.8	48.3	241.4	70.8
Etah	1186.3	471.4	714.9	39.7	32.5	162.5	55.0
Etawah	912.8	433.8	479.0	47.5	22.8	109.9	37.9
Farrukhabad	1203.7	577.4	626.4	48.0	28.5	142.4	51.0
Ghaziabad	1125.2	382.5	742.6	34.0	34.8	169.8	89.7
Meerut	1509.2	658.9	850.3	43.7	39.7	193.3	61.8
Mainpuri	1364.6	614.6	750.0	45.0	34.1	170.4	60.0
Mathura	1260.2	535.4	724.8	42.5	33.9	165.7	53.3
Moradabad	1878.8	721.6	1156.4	38.4	53.6	263.8	54.3
Muzaffarnagar	1836.1	668.8	1167.3	36.4	53.1	265.3	79.2
Pilibhit	1735.7	285.5	1450.2	16.5	66.9	330.6	149.3
Rampur	730.6	307.0	431.6	41.6	20.6	98.9	51.6
Saharanpur	2187.0	768.8	1410.2	35.2	64.1	321.5	84.2
Shahjahanpur	1636.2	566.7	1069.4	34.5	49.6	243.0	70.0
Barabanki	2398.5	529.3	1869.2	22.1	86.0	425.8	147.2
Fatehpur	1361.3	338.4	1022.9	24.9	46.5	232.4	77.7
Hardoi	1780.1	489.9	1290.2	27.5	59.6	293.2	73.2
Kanpur	1434.3	501.6	932.8	35.0	42.4	212.9	50.3
Lakhimpur Kheri	2884.6	932.0	1952.6	32.3	89.8	444.8	99.4
Lucknow	854.9	241.7	613.2	28.3	28.9	139.4	92.5
Rae Bareli	1953.9	517.7	1436.1	26.5	65.3	326.4	123.1
Sitapur	2925.9	1015.4	1910.5	34.7	87.8	434.2	105.1
Unnao	1652.5	440.5	1211.9	26.7	55.1	275.4	96.7

Contd....

Appendix VIII.3(i) (contd....)

Ailahabad	1525.6	605.1	920.4	39.7	42.8	209.2	43.9
Azamgarh	1967.5	863.3	1184.2	43.9	54.8	269.1	63.0
Bahraich	1785.9	323.2	1462.7	18.1	66.5	332.4	74.0
Ballia	1102.5	394.1	708.4	35.7	32.2	161.0	68.8
Basti	2799.3	925.8	1873.5	33.1	85.2	426.8	75.4
Deoria	2856.5	671.4	2185.2	23.3	99.3	497.6	116.0
Faizabad	1587.9	709.3	878.6	44.7	40.9	200.7	67.3
Ghazipur	1054.8	471.0	583.7	44.7	27.5	133.6	51.3
Gonda	2305.0	786.6	1518.5	34.1	69.0	345.1	70.1
Gorakhpur	3123.0	876.8	2246.2	28.1	102.1	511.5	102.8
Jaunpur	1398.3	641.1	757.2	45.9	34.4	172.1	59.3
Mirzapur	1567.4	172.9	1394.6	11.0	63.4	317.9	85.8
Pratapgarh	1254.7	432.8	821.8	34.5	37.4	187.8	82.6
Sultanpur	1742.5	486.4	1255.7	27.9	57.1	285.4	97.7
Varanasi	1213.5	504.0	709.4	41.5	32.2	161.2	49.5
Almora	-	-	-	-	-	-	-
Chamoli	-	-	-	-	-	-	-
Dehradun	557.7	15.7	542.0	2.8	25.6	123.2	114.8
Nainital	977.9	230.2	747.6	23.5	34.9	170.9	398.1
Pithoragarh	-	-	-	-	-	-	-
Pauri Garhwal	-	-	-	-	-	-	-
Tehri Garhwal	-	-	-	-	-	-	-
Uttar Kashi	-	-	-	-	-	-	-
Banda	950.9	159.6	790.5	16.8	36.9	180.7	34.9
Hamirpur	1527.7	188.7	1338.9	12.4	61.8	304.3	59.4
Jalaun	1332.1	112.4	1219.7	8.4	55.4	277.2	79.6
Jhansi	862.4	283.4	579.0	32.9	26.3	132.6	42.7
Lalitpur	874.0	238.8	635.1	27.3	29.3	144.3	74.0
UTTAR PRADESH	78348.8	25709.1	52640.7	32.8	2392.0	11962.7	69.4

Source : Calculated from Bulletin of Agricultural Statistics, Uttar Pradesh

Note : Data on water recharge and draft have been obtained from State Ground Water Organization. U.P., No. of feasible tubewells have been calculated at an average assumed discharge of 0.022 MCM per tubewell and irrigation potential has been calculated at the rate of 5 hectares per tubewell.

Appendix VIII.3(ii)Districtwise Ground Water Resources of M.P. (1983-84) and
Number of Feasible Ground Water Structures

Districts	Annual Utiliz- able Recharge (MCM)	Net Annual Draft (MCM)	Ground Water Balance (MCM)	Stage of Ground Water Develo- pment (%)	Addit- ional No.of Feasi- ble Tube- Wells (*000)	Addit- ional Area Irriga- ted by Addit- ional Tube- wells (*000 ha)	Addit- ional Area Irrig- ated As % of Net Sown Area
Balaghat	931	101	830	10.9	12.2	183.0	30.1
Bastar	5209	32	5177	0.6	76.1	1141.5	61.9
Betul	879	168	729	18.7	10.7	160.5	18.4
Bhind	783	91	692	11.6	10.2	153.0	20.6
Bhopal	236	73	163	30.7	2.4	36.0	10.5
Bilaspur	2408	86	2322	3.6	34.1	511.5	28.4
Chhatarpur	881	204	677	23.1	10.0	150.0	20.0
Chhindwara	966	265	701	27.5	10.3	154.5	14.3
Damoh	705	38	667	5.4	9.8	147.0	23.9
Datia	266	54	212	20.5	3.1	46.5	15.9
Dewas	605	171	434	28.3	6.4	96.0	12.3
Dhar	636	233	403	36.6	5.9	88.5	8.1
Durg	1022	74	948	7.3	13.9	208.5	17.0
Guna	1119	90	1029	8.1	15.1	226.5	17.2
Gwalior	870	113	757	13.0	11.1	166.5	29.5
Hoshangabad	2006	160	1846	8.0	27.1	406.5	41.0
Indore	368	167	201	45.4	3.0	45.0	7.7
Jabalpur	976	93	883	9.6	13.0	195.0	19.2
Jhabua	411	75	336	18.2	4.9	73.5	9.7
Khandwa	710	193	517	27.2	7.6	114.0	11.7
Khargone	954	310	644	32.4	9.5	142.5	15.1

Contd....

Appendix VIII.3(ii) contd....

Mandsaur	854	516	338	60.4	5.0	75.0	6.2
Mandla	2156	38	2118	1.8	31.1	466.5	49.4
Morena	1695	138	1557	8.1	22.9	343.5	39.3
Narsinghpur	832	97	735	11.7	10.8	162.0	26.3
Panna	690	38	652	5.4	9.6	144.0	30.1
Raigarh	1815	15	1800	0.8	26.5	397.5	34.0
Raipur	3262	163	3097	5.1	45.5	682.5	33.1
Raisen	763	56	707	7.4	10.4	156.0	17.1
Rajgarh	586	163	418	28.8	6.1	91.5	10.4
Rajnandgoan	1124	52	1072	4.6	15.8	237.0	21.3
Ratlam	513	197	316	38.4	4.6	69.0	10.2
Rewa	611	51	560	8.3	8.2	123.0	15.4
Sagar	1219	118	1101	9.7	16.2	243.0	21.5
Satna	792	84	708	10.7	10.4	156.0	20.1
Sehore	741	131	610	17.7	9.0	135.0	16.9
Seoni	968	76	892	7.9	13.1	196.5	23.3
Sahdol	1530	15	1515	1.0	22.3	334.5	33.6
Shajapur	528	144	384	27.3	5.6	84.0	9.1
Shivpuri	975	197	778	20.2	11.4	171.0	21.0
Sidhi	1080	130	950	12.0	14.0	210.0	27.7
Sarguja	3000	173	2827	5.8	41.6	624.0	48.6
Tikamgarh	695	220	475	31.5	7.0	105.0	20.2
Ujjain	537	185	352	34.4	5.2	78.0	7.7
Vidisha	835	41	794	5.0	11.7	175.5	15.7
MADHYA PRADESH	50760	5836	44924	11.5	660.6	9909.0	23.4

Source : Calculated from Bulletin of Agricultural Statistics, Madhya Pradesh (Annual)

Note : Data on water recharge and draft have been obtained from State Ground Water Organization, M.P. No. of feasible tubewells have been calculated at an average assumed discharge of 0.068 MCM per tubewell and irrigation potential has been calculated at the rate of 15 hectares per tubewell.

Chapter IX

FOREST RESOURCES

IX.1 Introduction

Forests play a vital role in maintaining ecological balance and provide valuable products for human and livestock consumption. An adequate forest cover and good condition of the forest stock are essential conditions for environmental stability and health of the land resources. Problems of soil erosion, floods, droughts, etc. are closely related to the process of deforestation. Thus, attention to the health of forest resources is imperative for maintaining the health of the land resources. In the present chapter, we look at the status of the forest resources in the Central Zone. The discussion covers issues like forest cover and types, trends in deforestation, forest produce, etc.

IX.2 Forest Cover

A good deal of controversy has waged around the question of the extent of forest cover in the country as the forest area assessed on the basis of landsat imagery is much smaller than what is reported in official statistics. The discrepancy is primarily on account of the fact that while landsat imagery data gives the figure of actual forest coverage, official statistics based on revenue department data classifies forest area on administrative basis without reference to actual forest coverage. In our opinion the

estimate based on land sat imagery should be taken as representing actual forest coverage, which is relevant from ecological point of view, whereas the official forest statistics should be taken as indicating the potential of extending forest coverage without diverting any land from other uses. The gap between the two should form the basis of urgent action plan by forest department for extending effective coverage of forests.

The Forest Survey of India has made an attempt to reconcile the divergent estimate of forest area and arrived at a figure which lies between the two estimates. We have given the different estimates of forest area for the two states of the Central Zone in Table IX.1. As the table shows 17.4 per cent of geographical area of U.P. is officially classified under forests, whereas according to NRSA estimates effective coverage of forests is only 9.4 per cent. Similarly forest cover in M.P. is 35.1 per cent of geographical area as per official statistics, but only 20.4 per cent as per NRSA estimates. Forest area as finally assessed by Forest Survey of India comes to 10.7 per cent of geographical area in U.P. and 28.8 per cent of geographical area in M.P. These two states account for 4.9 per cent and 19.9 per cent of total forest area of the country respectively. Thus, in U.P. effective forest cover falls much short of the one-third coverage recommended by the National Forest Policy, 1952. In M.P., however, the short fall is much less and the situation is not as alarming as in

U.P. Moreover, the much large gap in the finally assessed and officially reported area in the case of U.P. reflects the poor conditions of the forest land in the state.

Table IX.1

Estimates of Forest Cover in Central Zone : 1981-83

(Area in Sq.Km)

Source	U.P.		M.P.	
	Actual	Percent	Actual	PerCent
1. Forest Area as Officially Reported	51269	17.4	155414	35.1
2. Forest Area as Assessed by National Remote Sensing Agency	27780	9.4	90215	20.4
3. Forest Area as Finally Assessed by Forest Survey of India	31443	10.7	127749	28.8
4. Finally Assessed Area As Per Cent of Officially Reported Area	61.3	-	82.2	-
5. Finally Assessed Area as Per Cent of India	4.9	-	19.9	-

Source : Forest Survey of India, The State of Forest Report, 1987, Ministry of Environment and Forest, Government of India, Dehradun, pp.36-37.

The forest cover inadequate as it is distributed highly unevenly over space. In Chapter VI we have indicated the distribution of forest area according to official statistics. Here we limit our discussion to the forest area based on landsat imagery 1980-82 as calculated by us from NRSA maps, which shows actual forest cover. Appendix IX.1(i) and IX.1(ii) show districtwise forest area in U.P. and M.P. Inadequacy of forest cover in the zone is highlighted by the

fact that only three districts in U.P. and seven districts in M.P. have over 30 per cent area under forests, the minimum required for ecological balance (Map IX.1 and Table IX.2).

Table IX.2

Distribution of Districts According to Per Cent of Forest Cover in Central Zone

(Nos.)

Per Cent Area Under Forest To Total Area	U.P.	M.P.
Negligible	33	5
Below 2.5	5	4
Between 2.5 and 5.0	3	1
Between 5.0 and 10.0	4	11
Between 10.0 and 20.0	4	11
Between 20.0 and 30.0	4	7
Between 30.0 and 40.0	2	2
Above 40.0	1	5
All Districts	56	45

Source : Calculated from NRSA Maps, 1980-82

In U.P. forests are confined to the hill region, tarai belt along the Himalayas, Bundelkhand region and Mirzapur district of east U.P. (Map IX.1). The districts of U.P. plains have been almost completely denuded of forest cover with as many as 33 districts being without any effective forest cover (Table IX.2). Though Hill Region accounts for about two-thirds of forest area of the state, here also the

forest cover is only 27.8 per cent against the recommended norm of 60 per cent. Thus, the entire state is highly deficient in respect of forest cover.

In M.P. the situation in this respect is less unsatisfactory. Here 14 districts have effective forest cover of over 20 per cent. However, five districts of M.P. are without any forest cover and in another four districts less than 2.5 per cent area is under forests. In general, forest cover is better in the eastern and southern parts of the state as compared to the western and northern parts (Map IX.1).

IX.3 Trends in Forest Area

The Central Zone, which in historical past had a rich forest cover, has undergone a prolonged process of deforestation over centuries as increasing population pressure forced people to bring more and more area under the plough. The process of deforestation has been carried to its extreme in the fertile Gangetic plains of U.P., while the damage has been comparatively less in M.P. where population density is lower.

During the British rule a process of ruthless exploitation and cutting of forests for commercial purposes began. Among other things the requirement of laying down railway track took a heavy toll of the forests. The destruction of forests continued unabated for commercial and industrial purposes even after Independence due to shortsighted policies of the government and the unhealthy nexus between the forest officials and contractors.

Considerable area of forest land has also been diverted to non-forest use officially under the plans such as river valley projects, industries and townships, transmission lines, roads, agriculture, etc. Maximum diversion has taken place in Madhya Pradesh, where nearly 19 lakh hectares were diverted to non-forest use between 1951 and 1980. In U. P. the extension of diversion of forest area is reported at 2.5 lakh hectares over the same period.

As pointed out in Chapter VI according to official statistics forest area in U.P. declined between 1955-1965 by 3.6 lakh hectares, increased by 13.8 lakh hectares between 1965-1975 and has remained static after that (Table VI.2). In M.P. official statistics show that forest area increased by 8.0 lakh hectares between 1956 and 1971, but it declined by 5.5 lakh hectares between 1971 and 1986 (Table VI.5).

We may here discuss the trends in effective forest coverage on the basis of forest area computed by us from NRSA maps for 1972-75 and 1980-82. As Table IX.3 reveals 12.2 per cent of forest area amounting to 1.65 per cent of geographical area was lost in U.P. through deforestation during this period.

Central region of U.P. shows a marginal increase in forest cover, while all the other regions show a loss of forest cover, the loss being really alarming in the ecologically fragile zone of U. P. Himalayas, where forest cover declined by as much as 8.56 per cent of geographical area.

Table IX.3

Trends in Forest Area in Central Zone : 1972-75 to 1980-82

State/ Region	Percentage to Total Geographical Area						
	Closed Forest Area			Open Forest Area			Total Forest Area
	1972-1980-Diffe- 75 82 rence	1972-1980-Diffe- 75 82 rence	1972-1980-Diffe- 75 82 rence	1972-1980-Diffe- 75 82 rence	1972-1980-Diffe- 75 82 rence	1972-1980-Diffe- 75 82 rence	1972-1980-Diffe- 75 82 rence
A. U.P.	8.22	6.17	-2.05	0.57	0.97	+0.40	8.79
Western Region	1.79	1.59	-0.20	0.06	0.04	-0.02	1.85
Central Region	1.49	1.58	+0.09	0.14	0.29	+0.15	1.63
Eastern Region	4.42	3.19	-1.23	0.42	1.34	-0.08	4.84
Hill Region	34.29	25.11	-9.18	2.11	2.73	-0.62	36.40
Bundelkhand	2.52	1.92	-0.60	0.42	0.47	+0.05	2.94
B. M.P.	20.03	15.61	-4.42	4.49	4.84	+0.35	24.51
Eastern Hill & Chattisgarh	30.80	27.67	-3.13	5.26	5.99	+0.73	36.06
Northern Plains & Plateaus	9.14	5.30	-3.84	0.88	1.72	+0.84	10.02
Central Plateau & Hills	15.20	9.22	-5.98	5.62	6.31	+0.69	20.82
Vindhayan Hills & Plateau	23.55	17.91	-5.64	3.91	4.14	+0.23	27.46
Malwa Plateau	8.28	3.73	-4.55	4.29	3.36	-0.93	12.57

Source : Based upon our calculations from NRSA maps of U.P. and M.P. for 1972-75 and 1980-82.

The pace of deforestation was even more rapid in Madhya Pradesh where 16.6 per cent of forest area amounting to 4.1 per cent of total geographical area has been lost within a period of one decade (Table IX.3). The process of

deforestation took place at a fairly rapid rate in all regions of the state. It will also be seen from the table that the loss of forest cover is mainly on account of wanton destruction of the closed forest area.

The latest data released by the Forest Survey of India provides a much needed relief from this depressing scenario. The data reproduced in Table IX.4 indicates that between the period 1981-83 and 1985-87 there was an actual if small increase in forest cover in both the states. Though open forest area has declined even during this period the loss was more than compensated by the increase in the closed forest area.

Though this is an happy augury the situation with respect to the forest cover in the Central Zone has to be carefully monitored and programmes for forest conservation and afforestation have to be undertaken with renewed vigour.

IX.4 Forest Types

The distribution of forests by legal status has been shown in Table IX.5. In U.P. 85.6 per cent of forests are reserved forests, 4.4 per cent are protected forests while 10.0 per cent are unclassified. In M.P. the proportion of reserved forests is only 52.1 per cent and that of protected forests is 44.5 per cent.

Table IX.6 shows the distribution of forests by altitude. 52.3 per cent of forests in U.P. and 86.1 per cent in M.P. occur at the height of below 600 M. A relatively larger proportion of forest area in U.P. is found on higher

altitudes - 33.3 per cent at the height between 600 - 1800 M.
and 14.4 per cent above 1800 M.

Table IX.4

Trends in Forest Area in Central Zone : 1981-83 to 1985-87

(Area in Sq.Km.)

Period/Source	U.P.		M.P.	
	Actual	Percent	Actual	Percent
A. <u>Close Forests</u>				
1981-83	18876	6.4	72174	16.3
1985-87	22632	7.7	91448	20.7
B. <u>Open Forests</u>				
1981-83	12567	4.3	55575	12.5
1985-87	11212	3.8	41743	9.4
C. <u>Total Forests</u>				
1981-83	31443	10.7	127749	28.8
1985-87	33844	11.5	133191	30.1
D. <u>Change 1985-87 over 1981-83</u>				
Close Forest	+3756	+1.3	+19274	+4.4
Open Forest	-1355	-0.5	-13832	-3.1
Total Forest	+2401	+0.8	+ 5442	+1.3

Source : Forest Survey of India, State of Forest Report, 1989, Ministry of Environment and Forest, Government of India, Dehra Dun.

Note : Per cent figures refer to proportion of forest area to total geographical area.

Table IX.5Forest Area By Legal Status in Central Zone : 1981-82
(Lakh hectare)

Legal Status	U.P.		M.P.	
	Area	Percent	Area	Percent
1. Reserved Forests	34.82	85.57	81.00	52.12
2. Protected Forests	1.79	4.40	69.08	44.45
3. Unclassed Forests	4.08	10.03	5.34	3.44
Total Forests	40.69	100.00	155.42	100.00

Source : Official Forest Statistics

Table IX.6Altitudinal Distribution of Forests in Central Zone, 1981-83

(In Sq. Km.)

Altitude	U.P.		M.P.	
	Actual	Percent	Actual	Percent
Upto 600 M	16435	52.3	109993	86.1
600 -- 1800 M	10481	33.3	17756	13.9
Above 1800 M	4527	14.4	-	-
Total Forests	31443		127749	

Source : Forest Survey of India, The State of Forest Report, 1987, Ministry of Environment and Forest, Government of India, Dehra Dun, p.41

Table IX.7 shows the distribution of forests in the Central Zone according to forests types. In M.P. nearly half of the forests belong to the tropical moist deciduous type

the remaining half being tropical dry deciduous forests. In U.P. forest area under these two categories is 22.4 per cent and 27.8 per cent respectively. About 27 per cent of forests in this state are sub-tropical pine forests, 20 per cent Himalayan moist temperate forest and 2 per cent are Alpine forests.

Table IX.7

Forest Cover by Different Forest Type in Central Zone
(Based on Land Sat Imageries of 1981-83) in Sq. Km.

Forest Type	U.P.		M.P.	
	Actual	Percent	Actual	Percent
1. Tropical Moist Deciduous Forest	7048	22.4	63992	50.1
2. Tropical Dry Deciduous Forest	8715	27.8	63575	49.8
3. Tropical Thorn Forest	201	0.6	182	0.1
4. Sub-Tropical Pine Forest	8455	26.9	-	-
5. Himalayan Moist Temperate Forest	6397	20.3	-	-
6. Sub-Alpine and Alpine Forest	627	2.0	-	-
Total Forest Area	31443	100.0	127749	100.0

Source : Forest Survey of India, The State of Forest Report, 1987, Ministry of Environment and Forest, Dehradun, pp.39-40.

Major tree species occurring under different forest types are indicated below:

- (i) Tropical Moist Deciduous Forest : Sal (Shorea Robusta), Sain (Terminalia Tomentosa), Dhawra (Lagerstroemia Parfilora), Haldu (Adina Cordifolia), Simul (Salmalia Malabarica), Kanju (Holoptelia Integrifolia), Gutel (Trewia Nudiflora), Khair (Acacia Katechu), Sissoo (Dalbergia Sissoo)
- (ii) Tropical Dry Deciduous Forest : Sal (Shorea Robusta), Haldu (Adina Cordifolia), Khair (Acacia Katechu), Sain (Terminalia Tomentosa), Bakli (Anogeissus Latifolia), Tendu (Diospyros Tomentosa), Kardhai (Anogeissus Pendula)
- (iii) Tropical Thorn Forest : Babul (Acacia Arabica), Jhand (Prosopis Spicigera)
- (iv) Sub-Tropical Pine Forest : Chir (Pinus Roxburghii)
- (v) Himalayan Moist Temperate Forest : Fir (Abies Pindrow), Spruce (Picea Smithiana), Deodar (Cedrus Deodara), Blue Pine (Pinus Wallichiana)
- (vi) Alpine Forest : Birch (Betula Utilis), Fir (Abies Wabiana), Alpine Scrub and low forests.

The tree varieties found over major parts of the Central Zone are valuable as a source of commercial timber, fuelwood or industrial wood. The present productivity levels are, however, very low for a variety of reasons.

IX.5 Forest Produce

Forests are an important source of a large variety of produce of economic importance. The trends in forest produce has, however, not been steady. The fifties and sixties saw a heavy exploitation of the forest resources to meet the growing demand for various purposes. Thus, timber production in U.P. which was around 3 lakh Cu.M. in 1950-51 reached the

peak level of 10.42 lakh Cu.M. in 1971-72 (Table IX.8). Since then the production of timber has gradually gone down in view of the need for conservation and ban on tree felling over a given height. It is currently around 7 lakh Cu.M. Similar trends are also observed in case of fuelwood production which initially went up from 15.4 lakh Cu.M. in 1950-51 to 25.64 lakh Cu.M. in 1973-74, but has since then gone drastically down to around 6 lakh Cu.M. in mid-eighties (Table IX.8).

Table IX.8

Trends in Timber and Fuel Wood Production in U.P. : 1951-87
(in Cubic Metre)

Year	Timber	Fuelwood
1950-51	309533	1536141
1955-56	400997	2076089
1960-61	421187	2118762
1965-66	756608	2359013
1970-71	991207	2478045
1971-72	1042651	2315275
1972-73	956145	2250563
1973-74	823017	2563877
1974-75	683656	2126653
1975-76	874147	2278427
1976-77	864549	2091742
1977-78	858745	2456553
1978-79	832926	2355274
1979-80	682839	2359103
1980-81	572427	1861767
1981-82	655365	1749806
1982-83	691977	1571091
1983-84	662674	1470803
1984-85	670764	637763
1985-86	704432	628495
1986-87	685861	619176

Source : Forest Department, U.P.

Trends in the output of important minor forest produce like bamboo, ringals, katha, tendu leaves and resin in U.P. have been shown in Table IX.9. Besides these a number of other minor produce is also obtained from the forests like honey, wax, gum, canes, thatching grass, medicinal herbs, etc.

Table IX.9

Trends in Output of Important Minor Forest Produce in U.P.

Items	Unit	1960-61	1980-81	1985-86
1. Bamboos	Nos. (Lakhs)	147.86	117.04	5.84
2. Ringals	Nos.	8.85	53.33	N.A.
3. Katha	M.T.	817	3807	1629
4. Tendu Leaves	M.T.	4729	14310	25398
5. Resin	M.T.	12802	16969	13642

Source : Forest Department, U.P.

Total value of forest produce in U.P. amounted to Rs.78.95 crores in 1986-87, out of which Rs.54.32 crores were contributed by timber, Rs.20.11 crores by minor forest produce and Rs.4.5 crores by fuelwood.

Table IX.10 shows the trends in the output of major forest produce in M.P. since 1960-61. The output of timber went up from 11.63 lakh tonnes in 1960-61 to 26.17 lakh tonnes in 1967-68. Since then timber output has maintained a downward though fluctuating trend and is currently around 10 lakh tonnes. Similarly fuelwood production has sharply fluctuated between 10.2 lakh tonnes and 40.67 lakh tonnes. It

is currently around 21 lakh tonnes. Trends in output of minor produce like bamboo, tendu leaves, gum, harra and sal seed have been shown in Table IX.11.

Table IX.10

Trends in Timber and Fuelwood Production in M.P. : 1960-86
(In thousand Cu.M.)

Year	Timber	Fuelwood
1960-61	1163	2923
1961-62	984	2361
1962-63	1164	3171
1963-64	1678	3448
1964-65	1543	2478
1965-66	1637	3270
1966-67	2297	3280
1967-68	2617	3632
1968-69	2108	3382
1969-70	2210	2871
1970-71	1502	1665
1971-72	1913	1476
1972-73	1556	2162
1973-74	666	1020
1974-75	800	1461
1975-76	811	1437
1976-77	822	1413
1977-78	1085	2289
1978-79	1381	4067
1979-80	1597	3783
1980-81	1690	4000
1981-82	1092	2260
1982-83	1500	3500
1983-84	1130	1814
1984-85	944	2029
1985-86	970	2100

Source : Forest Department, M.P.

Total revenue from forest produce in M.P. amounted to Rs.213.93 crores in 1986-87, out of which timber accounted for 151.77 crores, bamboo for 14.92 crores and other minor products for 6.86 crores.

Table IX.11

Trends in Output of Minor Forest Produce in M.P. : 1970-86

Year	Bamboo (M.T.)	Tendu Leaves (Std Bags in '000)	Gum (M.T.)	Harra (M.T.)	Sal Seed (M.T.)
1970-71	-	2144	2192	23539	-
1971-72	-	2425	2115	52503	-
1972-73	-	2594	1540	2118	-
1973-74	113169	2615	1314	6637	37426
1974-75	371222	2400	2105	5350	18430
1975-76	326392	2553	1500	9000	29345
1976-77	392180	2796	1126	22083	8213
1977-78	359036	3075	506	12693	103688
1978-79	400621	3080	924	12174	5310
1979-80	361749	3023	924	17578	69769
1980-81	267961	4574	317	4900	25315
1981-82	289124	3055	349	9160	73744
1982-83	280064	4850	118	20387	51280
1983-84	237378	5292	458	16763	58593
1984-85	336283	3878	590	6745	19808
1985-86	349000	5558	1607	9043	62750

Source : Forest Department, M.P.

The output figures discussed above indicate a very low level of productivity of the forest land in the Central Zone. On the basis of recorded produce of timber and fuelwood and the officially reported forest area total wood production per ha. comes to only 0.256 Cu.M. in U.P. and 0.192 Cu.M. in M.P. Productivity is somewhat higher - 0.418 and 0.234 Cu.M. respectively - if calculated in relation to actual forest cover as finally assessed by the Forest Survey of India (Table IX.12). When we make adjustment for unrecorded produce and theft - which is put at 10 per cent and 1000 per cent of recorded produce - even higher levels of productivity can be arrived at. Thus, adjusted productivity comes to 1.367

Cu.M. and 1.342 Cu.M. per ha. in U.P. and M.P. respectively in relation to official forest area and to 2.240 Cu.M. and 1.637 Cu.M. per ha. in relation to actual forest cover (Table IX.12).

Table IX.12

Productivity of Forests in Central Zone : Early 1980
(Output Per Hectare in Cu.M.)

Item	U.P.	M.P.
1. Actual Productivity Per. Ha. of Officially Reported Forest Area		
(a) Timber	0.134	0.065
(b) Fuelwood	0.122	0.127
(c) Total Wood	0.256	0.192
2. Adjusted Productivity		
(a) Timber	0.147	0.072
(b) Fuelwood	1.220	1.270
(c) Total	1.367	1.342
3. Productivity on Finally Assessed Forest Area (Total)		
(a) Actual	0.418	0.234
(b) Adjusted	2.240	1.637

Notes : 1. Actual Productivity has been calculated on the basis of officially reported forest produce and forest area.
2. Adjusted productivity has been calculated by adding 10 per cent to recorded timber output and 1000 per cent to recorded firewood output to account for unrecorded output and theft.

Actual productivity in regions well protected from biotic injuries has been estimated by FSI at 2.03 to 2.21 Cu. M. in the Himalayas, 1.05 Cu.M. in Central India and 0.08 Cu.M. in the Gangetic Plains. These figures are much lower than Paterson's estimate of average potential productivity of 6 Cu.M. per ha. for India.

IX.6 Demand on Forests

Due to small size of forest area per capita low productivity of existing forests and restriction on tree felling the supply of forest produce is extremely inadequate to meet the demand for various purposes. Particularly the demand - supply gap is staggering in case of firewood which is the major source of energy for the vast masses. The recorded supply of firewood is hardly 10-15 per cent of the consumption of firewood as per NSS results (Table IX.13). The gap between demand and supply comes to as much as 175 lakh Cu.M. in U.P. and 156 lakh Cu.M. in M.P. in 1983-84. A part of this gap is met by supply from private lands and gardens and trees around houses and by authorized collection from forests. However, there is little doubt that bulk of the unsatisfied demand is met through downright pilfrage on a large scale. Thus, the shortage of firewood has been a major cause of deforestation in the Central Zone as in other parts of the country.

The Forest Survey of India has estimated the demand of timber (wood other than firewood) for various purposes at 275.8 lakh Cu.M. This is quite close to the projection (low) of 300.3 lakh Cu.M. for 1985 of the National Commission on Agriculture, 1976. The Commission projected the increase in the demand for timber between three and four per cent per year. If we assume per capita demand for timber to be of the same order in the Central Zone as in the rest of India, total demand for timber would be roughly around 45 lakh Cu.M. in U.P. and 21 lakh Cu.M. in M.P. Against this the current

output of timber is only 7 lakh Cu.M. in U.P. and 10 lakh Cu.M. in M.P. Thus domestic recorded production of timber is barely 16 per cent of present demand for timber in U.P., while the corresponding figure for M.P. is 48 per cent.

Table IX.13

Consumption and Supply of Firewood in Central Zone
(Lakh Cu.M.)

Item	U.P.	M.P.
A) <u>Consumption of Firewood Based on NSS Survey</u>		
(a) 27th Round (1972-73)	247.51	222.81
(b) 32nd Round (1977-78)	203.97	168.11
(c) 38th Round (1983)	191.76	177.14
B) <u>Recorded Production</u>		
(a) 1972-73	22.51	21.62
(b) 1977-78	24.57	25.28
(c) 1983-84	14.98	20.93
C) <u>Demand Supply Gap (%)</u>		
(a) 1972-73	90.9	90.3
(b) 1977-78	88.0	85.0
(c) 1983-84	88.2	88.2

Source : C.S.O., National Accounts Statistics : Sources and Methods, 1989, Ministry of Planning, Government of India, New Delhi, pp.67-68.

IX.7 Biotic Pressure and Degradation of Forests

With increase in human and livestock population and the growing needs of industrial development and development projects the biotic pressure on forest resources has been continuously increasing threatening the very existence of forests with consequent ecological disaster. The forest area

per capita is 0.30 ha. in M.P. and as low as 0.05 ha. in U.P. according to official statistics. In terms of actual forest cover the area of forests per capita would be much less. Apart from diversion of forest area for other uses and large scale legal and illegal felling of trees for commercial purposes, serious damage has been caused by extraction of firewood by the villagers living in the vicinity of forests. Fire, theft and encroachment are other causes of forest degradation. About 14,500 ha. of forests in U.P. and 2,46,000 in M.P. are presently reported under encroachment. Problem of shifting cultivation is, however, not serious in the Central Zone. In M.P. 125 sq.km. of forest area (0.08 per cent of total forest area) is reported under shifting cultivation.

Overgrazing by the large livestock is another contributory factor in forest degradation. As pointed out in Chapter V grazing intensity is 4.4 cow units per hectare of open forest area in U.P. and 6.5 cow units in M.P. The areas of U.P. and M.P. bordering on Rajasthan also face the added pressure of migratory grazing.

The extent of open forests provide an indication of the degradation of the forest resources through over-exploitation. Only around two-thirds of the forest area in the Central Zone is classified as close forest having a canopy of 40 per cent while the rest is open forest with a canopy between 10 and 40 per cent (Table IX.4 and Map IX.4).

The process of degradation of forest through over exploitation and damage has reached such an alarming stage

that the process of natural regeneration has been seriously affected over large parts. According to the studies carried out by the Forest Survey of India, natural regeneration was found inadequate or absent in about 80 per cent of forest area in U.P. and 50 per cent of forest area in M.P. (Table IX.14).

Table IX.14

Regeneration Status of Forests in Central Zone (%)

State/Area	Area (sq.km)	Regeneration Status (%)			
		Profuse	Adequate	Inadequate	Absent
UTTAR PRADESH					
Saharanpur	4026	-	1.53	9.35	89.12
Southern U.P.	5354	-	1.43	21.65	76.92
Hill Region	9857	-	9.04	9.47	81.49
Alaknanda	3370	82.10	17.75	-	0.06
Total	22607	12.25	7.20	10.92	69.63
MADHYA PRADESH					
Indore	20258	8.56	25.55	65.43	0.45
Rajnandgaon,	5158	3.93	20.89	64.29	10.89
Balaghat	12962	4.86	80.14	14.59	0.41
Total	38378	6.69	43.36	48.11	1.84

Source : Forest Survey of India, The State Forest Report, 1987
Ministry of Environment and Forest, Government of
India, Dehra Dun, p.43.

IX.8 Forest Conservation and Development

The ruthless process of deforestation and degradation of forests has serious environmental consequences for the Central Zone. Many of the ecological problems of the region like soil erosion, sedimentation of reservoirs and river

beds, floods, droughts diversification, etc. are directly attributable to the damage caused to the forest resources by man and animal. It is of utmost concern that this process of deforestation and degradation of forests is brought to a halt at the earliest and the health of the forests restored. The first priority in land use planning has, therefore, to be to ensure adequate and effective coverage of forests in the Zone.

The first step has, of course, to be to restore effective green cover on the area officially classified as under forests. It is indeed shocking to find that hardly one-third of the official forest area in U.P. and one-half of forest area in M.P. is presently under close cover according to Remote Sensing data. Thus, the present forest area on which the protective cover is to be restored is as much as 34 lakh ha. in U.P. and 71 lakh ha. in M.P. (Table IX.15). A ten year action plan is required for the development of this area.

As far as the total coverage of forest area is concerned in U.P. it falls much short of the recommended coverage of one-third area envisaged under the National Forest Policy. In M.P. also where forest coverage is adequate on the whole, there are many parts where forest area is extremely inadequate. In our view it may not be practicable in near future to attain the ecologically optimum coverage of forests. A more modest aim is therefore recommended to be achieved in the next ten years, that is, a forest coverage of 60 per cent in U.P. hills, 10 per cent in U.P. Plains and 20

per cent in M.P. The existing forest area and the required forest area to attain the above norms for each district in U.P. and M.P. has been shown in Appendix IX.2(i) and IX.2(ii) respectively, while a synoptic picture has been given in Table IX.15.

Table IX.15

Existing and Required Forest Cover in the Central Zone
(Area in lakh ha.)

Item	Uttar Pradesh	Madhya Pradesh
1. Required Forest Area	56.73 (19.0)	88.42 (20.0)
2. Official Forest Area	51.70 (17.4)	140.30 (31.7)
3. Actual Close Forest	17.82 (6.0)	69.23 (15.7)
4. Forest Area To be Rejuvenated (2-1)	33.88 (11.4)	71.06 (16.1)
5. Additional Area to be Afforested (1-2)	14.61 (4.9)	11.39 (2.6)
6. Available Area Under Culturable Wasteland, Permanent Pastures, Area Under Misc. Trees and Old Fallows	19.70 (6.6)	22.34 (5.1)
7. Area to be Brought Under Agro Forestry	2.76 (0.9)	0.89 (2.0)

Note : 1. The figures have been derived by adding up district level figures for each item.
2. Figures in brackets show percentages to total geographical area.

To attain the recommended norm of forest coverage an additional area of 14.6 lakh ha. in U.P. and 11.4 lakh ha. in M.P. is to be brought under afforestation over the next ten years. This much of area can be made available by afforesting area presently under the categories like

culturable wasteland, pastures and grazing lands, area under miscellaneous tree crops and old fallows. While adequate area under these categories is available in a majority of districts, in three districts of M.P. and 17 districts of U.P. area under net sown area and current fallows needs to be diverted to agro forestry. Plantation of trees along canals, roads and railways under social forestry schemes would also help in restoration of ecological balance.

As our discussion has revealed no programme of forest conservation can hope to succeed unless adequate provisions are made to meet the shortage of fuelwoods. The programmes of afforestation suggested above would contribute in a large measure to the augmentation of supply of fuelwood. Arrangements of transport and supply of fuelwood in different areas need to be made along with supply of improved chulhas and non-wood fuel sources like LPG, particularly in the areas in and around forests. These programmes have to be enmeshed with micro level planning for a group of villages to meet their energy requirements.

Similarly grazing has to be properly regulated keeping in mind the carrying capacity of the forest land in each area to prevent damage due to excessive grazing.

With scientific management and protection policies and strengthening of infrastructure the productivity of the existing forests can be enhanced several fold. Environmental balance rather than short term revenue maximization has to be the guiding principle of forest policy.

Finally, it may be emphasized that no programme of forest conservation and development is likely to be successful without ensuring peoples' participation. One can not ignore the relationship between man and forests specially in the hill and tribal areas. Desired results can be achieved with arrangement for the basic requirements of fuelwood, timber, etc. of the local people, regulated rights of forest produce, proper education and organization of the people for protection and development of forest resources keeping in mind ecological and longterm consequences in mind.

Appendix IX.1(i)Area Under Forest In Uttar Pradesh : 1980-82
(Based on Land Sat Imagery)

District	Closed Forest Area (K.M ²)	Open Forest Area (K.M ²)	Total Forest Area (K.M ²)	% of Closed Forest Area to Total Area	% of Open Forest Area to Total Area	Percent of Total For- est Area to Total Area
Agra	-	-	-	-	-	-
Aligarh	-	-	-	-	-	-
Bareilly	-	-	-	-	-	-
Bijnor	361	-	361	7.4	-	7.4
Budaun	-	-	-	-	-	-
Bulandshahr	-	-	-	-	-	-
Etah	-	-	-	-	-	-
Etawah	-	-	-	-	-	-
Farrukhabad	-	-	-	-	-	-
Meerut	-	-	-	-	-	-
Ghaziabad	-	-	-	-	-	-
Mainpuri	-	-	-	-	-	-
Mathura	-	-	-	-	-	-
Moradabad	-	-	-	-	-	-
Muzaffarnagar	-	-	-	-	-	-
Pilibhit	405	12	417	11.5	0.3	11.9
Rampur	25	-	25	1.1	-	1.1
Saharanpur	447	24	471	8.0	0.4	8.4
Shahjahanpur	70	-	70	1.5	-	1.5
Barabanki	-	-	-	-	-	-
Fatehpur	-	-	-	-	-	-
Hardoi	-	-	-	-	-	-
Kanpur	-	-	-	-	-	-
Lakhimpur Kheri	723	131	854	9.4	1.7	11.1
Lucknow	-	-	-	-	-	-
Rae Bareli	-	-	-	-	-	-
Sitapur	-	-	-	-	-	-
Unnao	-	-	-	-	-	-

Contd....

Appendix IX.1(i) (contd.....)

Allahabad	26	27	53	0.4	0.4	0.8
Azamgarh	-	-	-	-	-	-
Bahraich	480	13	493	7.0	0.2	7.2
Ballia	-	-	-	-	-	-
Basti	-	-	-	-	-	-
Deoria	-	-	-	-	-	-
Faizabad	-	-	-	-	-	-
Ghazipur	12	-	12	0.4	-	0.4
Gonda	320	12	332	4.4	0.2	4.5
Gorakhpur	223	-	223	3.6	-	3.6
Jaunpur	-	-	-	-	-	-
Mirzapur	1507	952	2459	13.3	8.4	21.7
Pratapgarh	-	-	-	-	-	-
Sultanpur	--	-	-	-	-	-
Varanasi	166	151	317	3.3	3.0	6.2
Almora	2569	105	2674	47.7	2.0	49.7
Chamoli	1933	7	1940	21.2	0.1	21.3
Dehradun	806	37	843	26.1	1.2	27.3
Nainital	2242	106	2347	33.0	1.6	34.6
Pithoragarh	1626	30	1656	18.4	0.3	18.7
Pauri Garhwal	1684	419	2103	31.0	7.7	38.7
Tehri Garhwal	732	393	1145	17.0	8.9	25.9
Uttar Kashi	1224	300	1524	15.3	3.7	19.0
Banda	200	69	269	2.6	0.9	3.5
Hamirpur	12	19	31	0.2	0.3	0.5
Jalaun	-	-	-	-	-	-
Jhansi	-	-	-	-	-	-
Lalitpur	352	50	402	7.0	1.0	8.0
UTTAR PRADESH	18165	2856	2102	6.2	1.0	7.0

Source : Forest Data Calculated from Remote Sensing Map of U.P.,
1980-82.

Appendix IX.1(ii)Area Under Forest In Madhya Pradesh : 1980-82
(Based on Land Sat Imagery)

District	Closed Forest Area (K.M ²)	Open Forest Area (K.M ²)	Total Forest Area (K.M ²)	% of Closed Forest Area to Total Area	% of Open Forest Area to Total Area	Percent of Total For- est Area to Total Area
Balaghat	4016	153	4169	43.5	1.7	45.2
Bastar	13404	3863	17267	34.3	9.9	44.2
Betul	1647	334	1981	16.4	3.3	19.7
Bhind	-	-	-	-	-	-
Bhopal	107	50	157	3.9	1.8	5.7
Bilaspur	4343	1087	5430	21.8	5.5	27.3
Chhatarpur	830	161	991	9.6	1.9	11.4
Chhindwara	1608	1078	2686	13.6	9.1	22.7
Dhamoh	559	671	1230	7.7	9.2	16.8
Datia	-	-	-	-	-	-
Dewas	599	456	1055	8.5	6.5	15.0
Dhar	29	23	52	0.4	0.3	0.6
Durg	231	348	579	2.8	4.1	6.8
Guna	1024	449	1473	9.3	4.1	13.3
Gwalior	-	58	58	-	1.1	1.1
Hoshangabad	2115	265	2380	21.1	2.6	23.7
Indore	75	165	240	1.9	4.2	6.2
Jabalpur	1352	412	1764	13.3	4.1	17.4

Contd...

Annexure IX.1(ii) (contd....)

Jhabua	407	24	431	6.0	0.4	6.4
Khandwa	1738	763	2501	16.1	7.1	23.2
Khargone	142	949	1091	1.1	7.1	8.1
Mandsaur	73	19	92	0.8	0.2	0.9
Mandla	3551	439	3990	26.8	3.3	30.1
Morena	828	113	941	7.1	1.0	8.1
Narshimpur	195	614	809	3.8	12.0	15.8
Panna	1437	328	1765	20.1	4.6	24.7
Raigarh	2557	-	2557	19.8	-	19.8
Raipur	4742	1247	5989	22.3	5.9	28.2
Raisen	218	1311	1529	2.6	15.5	18.1
Rajgarh	36	393	429	0.6	6.4	7.0
Rajnandgaon	3784	670	4454	34.0	6.0	40.0
Ratlam	-	-	-	-	-	-
Rewa	200	132	332	3.2	2.1	5.3
Sagar	477	445	922	4.7	4.3	9.0
Satna	897	178	1075	12.0	2.4	14.3
Sehore	162	275	437	2.5	4.2	6.6
Seoni	1224	525	1749	14.0	6.0	20.0
Shahdol	2961	658	3619	21.1	4.7	25.8
Shajapur	-	-	-	-	-	-
Shivpuri	760	430	1190	7.4	4.2	11.6
Shidhi	2742	621	3363	26.1	5.9	32.0
Surguja	7804	1459	9263	34.9	6.5	41.5
Tikamgarh	91	50	141	1.8	1.0	2.8
Ujjain	-	-	-	-	-	-
Vidisha	263	236	499	3.6	3.2	6.7
MADHYA PRADESH	69228	21452	90680	15.6	4.8	20.5

Source : Forest Data Calculated from National Remote Sensing Map of M.P., 1980-82.

Appendix IX.2(i)Existing and Required Forest Cover in U.P.

(in '000 ha.)

District	Required Forest Area	Official Forest Area	Actual Close Forest	Forest Area to be Reju- venated	Additi- onal Area to be for- ested	Available Area Un- der Cultu- rable Was- teland, Per- manent Pa- sture, Area Under Pre- sent & Old Fallows	Area To be Brou- ght Under Agro- Fore- stry
Agra	48	40	-	40	8	21	-
Aligarh	50	1	-	1	49	24	25
Bareilly	41	-	-	-	41	11	30
Bijnor	49	70	36	34	-	-	-
Budaun	52	7	-	7	45	30	15
Bulandshahr	44	9	-	9	35	24	11
Etah	44	1	-	1	43	71	-
Etawah	44	39	-	39	5	31	-
Farrukhabad	42	42	-	42	-	-	-
Meerut	39	8	-	8	31	11	20
Ghaziabad	26	3	-	3	23	73	-
Mainpuri	43	6	-	6	37	50	13
Mathura	38	2	-	2	36	19	18
Moradabad	59	20	-	20	39	21	18
Muzaffarnagar	42	7	-	7	35	12	23
Pilibhit	35	79	41	38	-	-	-
Rampur	24	7	3	4	17	4	13
Saharanpur	55	79	45	34	-	-	-
Shahjahanpur	46	11	7	4	35	26	9
Barabanki	45	8	-	8	37	50	-
Fatehpur	42	6	-	6	36	38	-
Hardoi	60	7	-	7	53	67	-
Kanpur	62	12	-	12	50	54	-
Lakhimpur Kheri	77	164	72	92	-	-	-
Lucknow	25	11	-	11	14	35	-
Rae Bareli	46	7	-	7	39	75	-
Sitapur	57	5	-	5	52	34	18
Unnao	46	16	-	16	30	63	-

Contd....

Appendix IX.2(i) (contd.....)

Allahabad	74	20	3	17	54	81	-
Azamgarh	57	-	-	-	57	42	15
Bahraich	69	102	48	54	-	-	-
Ballia	32	-	-	-	41	15	-
Easti	73	6	-	6	67	54	13
Deoria	54	1	-	1	53	24	29
Faizabad	44	1	-	1	43	50	-
Ghazipur	33	-	1	-	33	18	-
Gonda	74	71	32	39	3	50	-
Gorakhpur	66	56	22	34	10	24	-
Jaunpur	40	-	-	-	40	35	5
Mirzapur	120	488	151	337	-	-	-
Pratapgarh	36	-	-	-	36	48	-
Sultanpur	44	2	-	2	42	53	-
Varanasi	51	76	17	59	-	-	-
Almora	440	394	257	137	46	172	-
Chamoli	535	527	193	334	8	123	-
Dehradun	190	220	81	139	-	-	-
Nainital	421	404	224	180	17	52	-
Pithoragarh	380	330	163	167	50	188	-
Pauri Garhwal	439	455	168	287	-	-	-
Tehri Garhwal	343	397	75	322	-	-	-
Uttar Kashi	480	710	122	588	-	-	-
Banda	78	79	20	59	-	-	-
Hamirpur	72	38	1	37	34	62	-
Jalaun	46	26	-	26	20	19	1
Jhansi	50	33	-	33	17	73	-
Lalitpur	51	67	-	67	-	-	-
UTTAR PRADESH	5673	5170	1782	3388	1461	1970	276

Appendix IX.2(ii)Existing and Required Forest Cover in M.P.

(in '000 ha.)

District	Requ- ired For- est Area	Offi- cial For- est Area	Actual Close Forest	Forest Area to be Reju- venated	Additi- onal Area to be for- ested	Available Area Un- der Cultu- rable Was- teland, Per- manent Pa- sture, Area Under Pre- sent & Old Fallows	Area To be Brou- ght Under Agro- Fore- stry
Raipur	425	777	474	303	-	-	-
Durg	174	100	23	77	74	114	-
Rajnandgaon	222	389	378	11	-	-	-
Bastar	781	2451	1340	1111	-	-	-
Bilaspur	393	775	434	341	-	-	-
Sarguja	440	1084	780	304	-	-	-
Raigarh	260	402	256	146	-	-	-
Jabalpur	202	159	135	24	43	212	-
Balaghat	184	458	402	56	-	-	-
Chindwara	237	444	161	283	-	-	-
Seoni	174	320	122	198	-	-	-
Mandla	265	570	355	215	-	-	-
Narsinghpur	103	136	20	116	-	-	-
Sagar	205	292	48	244	-	-	-
Damoh	146	264	56	208	-	-	-
Panna	140	237	144	93	-	-	-
Tikamgarh	101	63	9	54	38	110	-

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Appendix IX.2(ii) (contd.....)

Chhatarpur	173	86	83	3	87	237	-
Rewa	126	67	20	47	59	171	-
Shidhi	208	438	274	164	-	-	-
Satna	148	133	90	43	15	97	-
Shahdol	277	540	296	244	-	-	-
Indore	77	52	8	44	25	40	-
Dhar	164	115	3	112	49	85	-
Jhabua	136	113	41	72	23	67	-
Khargone	270	470	14	456	-	-	-
Khandwa	222	506	174	332	-	-	-
Ujjain	122	8	-	8	114	96	18
Mandsaur	189	106	7	99	83	103	-
Ratlam	97	35	-	35	62	70	-
Dewas	140	204	60	144	-	-	-
Shajapur	124	3	-	3	121	94	27
Morena	234	325	83	242	-	-	-
Bhind	89	7	-	7	82	38	44
Gwalior	104	109	-	109	-	-	-
Shivpuri	203	192	76	116	11	267	-
Guna	220	152	102	50	68	176	-
Datia	41	20	-	20	21	23	-
Bhopal	54	39	11	28	15	48	-
Sehore	131	172	16	156	-	-	-
Raisen	170	334	22	312	-	-	-
Vidisha	146	105	26	79	41	63	-
Betul	202	407	165	242	-	-	-
Rajgarh	122	14	4	10	108	123	-
Hoshangabad	200	360	212	148	-	-	-
MADHYA PRADESH	8842	1403	6923	7106	1139	2234	89

Chapter X

WASTELAND DEVELOPMENT

X.1 Introduction

Due to the relentless growth of population the margin of cultivation has continuously expanded over time. Not only the bulk of cultivable area in the Central Zone has already been brought under the plough, but in fact cultivation has expanded over poor quality marginal lands. At the same time a considerable part of our land resources are without adequate vegetative cover and are lying waste as they are suffering from various degrees of degradation.

While there are a number of natural causes of land deterioration like location, environment, chemical and physical properties of soil, rain and wind erosion, the 'wanton misuse and interference by men and animals' have played a major role in bringing about this state of affairs. To name a few causative factors one may mention use of marginal land for agriculture, lack of appropriate water and soil management, road building, fragile hill mining, overgrazing, deforestation, etc. Once the ecological balance is disturbed a chain reaction sets in to cause further land degradation.

It is, therefore, imperative that the wastelands are reclaimed and put under adequate vegetative cover to preserve the environment. Moreover, given the rapid increase in human and livestock population it is necessary to ensure that our land resources are utilized to yield their full productive potential. This would imply, beside raising the yields on the presently cultivated area, reclamation of the vast area lying as wasteland for agricultural or forestry purposes. The present chapter is devoted to a discussion of the problem of wasteland development in the Central Zone.

X.2 What Are Wastelands

An assessment of the magnitude of the area under wasteland is beset with problems both of definition and availability of data. Some scholars have defined wasteland as that land which has previously been used but which has been abandoned and for which no further use has been found. The Committee on National Resources of the Planning Commission¹ adopted a broader approach and included under wasteland the following categories of land

1. Lands not available for cultivation, barren and uncultivable waste;
2. Other uncultivated land excluding fallow, culturable waste, permanent pastures and land under miscellaneous trees; and,
3. Fallow land.

1. Committee on National Resources, Study on Wasteland Including Saline and Alkali and Waterlogged Lands and Their Reclamation Measures, Planning Commission, New Delhi, 1963.

The National Wasteland Development Board has adopted the following definition:

"Wastelands mean degraded land which can be brought under vegetative cover, with reasonable effort, and which is currently lying unutilized and land which is deteriorating for lack of appropriate water and soil management or on account of natural causes. Wasteland can result from inherent/imposed disabilities such as by location, environment, chemical and physical properties of the soil or financial or management constraints."

The revenue statistics of the state include data on (a) barren and unculturable land; and (b) culturable wasteland. The first category includes land covered by mountains and deserts, etc., which can not be brought under cultivation unless at a high cost, while the latter category includes land available for cultivation whether or not taken up for cultivation once but not cultivated during the current year and last five years or more in succession. The National Commission on Agriculture was, however, of the view that the entire area classified as groves, fallows, pastures and culturable wasteland was degraded. In addition, large parts of the area classified as forest land are suffering from varying degrees of degradation. The estimates of wasteland would, therefore, vary depending upon which particular category of land is included or excluded.

X.3 Estimates of Wastelands

Table X.1 gives the estimates of wasteland in the

Central Zone according to the revenue records and the NRSA data. The two estimates are vastly different and irreconcilable. Thus in U.P. total wasteland as per revenue records is 22.38 lakh ha. against the NRSA estimate of 43.18 lakh ha. The major difference is in the category of culturable waste. It looks that degraded area under categories like pastures, old fallows and part of cultivated area is included in the NRSA estimate of culturable wasteland. In case of M.P. the NRSA estimate of culturable wasteland is much larger than shown by the revenue records, whereas NRSA estimate of barren and uncultivable land is on a much lower side and seems apparently wrong. Studies are, therefore, called for reconciling the two sets of data and arrive at a more accurate estimate of wasteland in the zone.

More recently the Regional Remote Sensing Application Centres have carried out detailed studies of wastelands in selected districts using 1986 landsat imagery on a scale of 1 : 50000. We could obtain data on wasteland for 20 districts of U.P. According to this study total wasteland in 20 selected districts of U.P. is 9.97 lakh ha. which roughly tallies with the revenue statistics which put the total cultivable and non-cultivable wastelands in these districts at 8.66 lakh ha. However, our computation from the NRSA wasteland maps for 1982 gives a figure of wastelands for these districts at 18.99 lakh ha. The major differences in the two estimates are for the categories of gullied or ravinous land and land affected with salinity. This strengthens our hunch that the 1982 estimates of wastelands include some area

under cultivation, pastures, etc. On the whole the reliability of the new estimates seems to be greater.

Table X.1

Wasteland In the Central Zone As Per Revenue Records and Satellite Imagery

Category	Wasteland in '000 ha. According to	
	Revenue Records	NRSA Estimate
A. UTTAR PRADESH		
1. Barren & Uncultivable Land	1112 (3.8)	1512 (3.9)
2. Culturable Wasteland	1126 (3.8)	2806 (9.5)
3. Total Wasteland	2238 (7.6)	4318 (13.2)
B. MADHYA PRADESH		
1. Barren & Uncultivable Land	2338 (5.3)	311 (0.7)
2. Culturable Wasteland	1778 (4.0)	2340 (5.3)
3. Total Wasteland	4116 (9.3)	2912 (6.0)

Note : Figures in brackets show per cent of wasteland to total geographical area.

Source : 1. Agricultural Statistics for U.P. and M.P.
2. Remote Sensing Agency, Mapping of Wastelands in India From Satellite Imagery - 1980-82,
Hyderabad.

X.4 Types of Wasteland

Broadly the wastelands are classified into two categories - culturable wastelands and non-culturable wastelands. The Remote Sensing Agency has given an elaborate classification of the wasteland, which is reproduced below:

A. Culturable Wasteland

1. Gullied and/or ravinous land
2. Upland with or without scrub
3. Waterlogged and marshy land
4. Land affected by salinity/alkalinity

5. Shifting cultivation area
6. Sands
7. Wasteland arising out of mining and industrial activity

B. Non-Cultivable Wasteland

8. Barren rocky area
9. Steep sloping area
10. Snow covered and/or glacial areas

Table X.2 presents the NRSA estimate of major categories of wasteland in the Central Zone based on land sat imagery for 1980-82. Around 70 per cent of the wastelands in U.P. and 88 per cent in M.P. are culturable wastelands.

Table X.2

Wasteland in the Central Zone by Category According to Land Sat Imagery, 1980-82
(Area in '000 hectares)

Category of Wasteland	U.P.	M.P.
A. <u>Culturable Wasteland</u>	2806 (70.9)	2340 (88.3)
1. Salt Affected Land	✓1282 (32.4)	-
2. Gullied & Ravinous Land	996 (25.2)	1247 (47.1)
3. Water Logged Land	✓220 (5.6)	-
4. Undulated Uplands	117 (2.9)	1057 (39.9)
5. Jhum or Forest Blanks	61 (1.6)	290 (1.1)
6. Sandy Area	130 (3.3)	7 (0.3)
B. <u>Non-Culturable Wasteland</u>	1512 (29.1)	311 (11.8)
C. <u>Total Wasteland</u>	4318 (100.0)	2912 (100.0)

Source : National Remote Sensing Agency, Mapping of Wastelands in India From Satellite Imagery, 1980-82, Hyderabad.

One-third of the wasteland in U.P. is suffering from soil salinity and alkalinity, while another one-fourth is under gullied or ravinous land. The problem of water logging

also occurs along the canal banks and in the flood prone eastern U.P. In M.P., on the other hand, the problems of soil salinity and water logging are hardly to be found. Here the major types of wasteland are gullied or ravinous land and undulating uplands with or without scrubs. Jhum cultivation is also found though on a limited scale. Some tracts in the state are also suffering due to mining operations. Though around 13.56 per cent of total wastelands in the country are found in the Central Zone, nearly 33 per cent of country's salt affected land, 50 per cent of country's gullied and ravinous land and 25 per cent of water logged land are found to occur in the Central Zone.

X.5 Spatial Distribution of Wastelands

The extent of culturable and non-culturable wasteland as per revenue statistics has been discussed in Chapter VI. Here we will look at the spatial distribution of different types of districts as per the estimates based upon remote sensing data. Appendix X.1(i) and X.1(ii) show the extent of wasteland by type across districts based on NRSA map for 1980-82 in U.P. and M.P., while Annexure X.2 shows the area under wasteland for 20 selected districts of U.P. for 1986. The picture is summarized in Table X.3 and X.4 and Map X.1 and X.2.

Table X.3Distribution of Districts According to Per Cent Area Under
Wasteland in Central Zone, 1980-82

(Nos)

Percentage of Area Under Waste- land to Total Reported Area	U.P.	M.P.
Below 2.5	11	6
Between 2.5 and 5.0	5	10
Between 5.0 and 10.0	9	15
Between 10.0 and 15.0	10	8
Between 15.0 and 20.0	10	4
Above 20.0	11	2
Total Districts	56	45

Source : Based on Appendix X.1(i) and X.1(ii)

Table X.4Distribution of Districts According to Per Cent Area Under
Culturable Wasteland in Central Zone, 1980-82

(Nos)

Percentage of Area Under Waste- land to Total Reported Area	U.P.	M.P.
Below 2.5	17	7
Between 2.5 and 5.0	5	11
Between 5.0 and 10.0	6	16
Between 10.0 and 15.0	12	7
Between 15.0 and 20.0	7	2
Above 20.0	9	2
Total Districts	56	45

Source : Based on Appendix X.1(i) and X.1(ii)

In as many as 31 districts of U.P. and 14 districts of M.P. over 10 per cent of the area is under wasteland. Bulk of this area is under culturable wasteland. Thus, culturable

wasteland covers more than 10 per cent of the geographical area in 26 districts of U.P. and 11 districts of M.P. Large tracts of wasteland are found to occur in the area lying in the Ganga-Yamuna doab of U.P. and along the Chambal in U.P. and M.P. border.

The problem of salt affected land is widespread in the districts of the Gangetic plains in U.P. Gullied and ravinous lands occur mostly in some districts of west U.P. and Bundelkhand along the rivers Chambal and Yamuna. Problem of water logging is more common in the districts of Central and eastern U.P., while sandy tracts occur in some western districts. In the Hill region and in two districts in the tarai belt - Pilibhit and Lakhimpur Kheri - large patches of forest blanks are to be observed.

In the districts of Madhya Pradesh the problems of gullied and ravinous land, undulating uplands and forest blanks are fairly widespread, but the problems of salt affected lands, water logging or sandy areas are come across only on a limited scale.

X.6 Technical and Economic Factors In Wasteland Reclamation

The methods of wasteland reclamation and their economic benefits would vary according to the location, nature and extent of deterioration of the wastelands. During the last two decades considerable experience has been gained in wasteland reclamation technology in different parts of the country. Here we may briefly discuss the technological and economic aspects of wasteland development with particular

focus on the major types of wastelands found in the Central Zone.

X.6.1 Salt Affected Land

The salt contents in soil get accumulated under faulty drainage conditions and come to the soil surface with evaporation and adversely affect all kinds of vegetation. Salt affected lands, called usar in common parlance, are formed both by natural causes as climate, topography and hydrology and man made causes like excessive use of canal water, high doses of fertilizers, overgrazing, obstruction to natural drainage, etc. In fact, the problem of soil deterioration emerged on a large scale in U.P. more than a century ago with the spread of the canal network and the Reh Commission was set up as early as 1876. About half a century later the Usar Land Reclamation Committee was appointed by the State Government in 1938-39.

Today, official estimates put the figure of salt affected or usar lands at 12.95 lakh ha. in U.P. and 2.42 lakh hectares in M.P. The problem extends over 20 districts of the Gangetic plains in U.P. between Aligarh and Azamgarh. The main affected districts of M.P. are East Nimar, West Nimar, Dhar, Bhind, Morena, Gwalior and Shivpuri. The NRSA estimate of usar lands for 1980-82 are also roughly of the same order for U.P. (12.82 lakh ha.). But the recent Remote Sensing Application Centre, Lucknow study puts the figure on a lower side - 4.34 lakh ha. in 20 wasteland affected districts.

Three categories of salt affected soils are distinguished on the basis of the chemical composition:

- (a) Saline soils, which are characterized by chloride and sulphate;
- (b) Alkali soils, which have preponderance of carbonate and bicarbonate; and,
- (c) Degraded alkali, which are similar to alkali soils in physical conditions with salts almost completely removed and are very difficult to reclaim.

In U.P. most of the salt affected land belongs to the category of alkali soils, while saline soils are found on a much smaller scale. The method of soil reclamation varies in the two cases. The package of reclamation technology consists of proper levelling and drainage, suitable soil amendment usually consisting of gypsum or pyrites, use of groundwater to lower the water table and proper crop sequence and agronomy practices.

Despite the successful adoption of the reclamation technology in Punjab and Haryana the progress of usar reclamation in U.P. has been slow due to slackness on the part of the state government. Successful cases of usar reclamation are, however, reported on Chakeri farm near Kanpur and experimental farms at Rahimabad and Katiyar in Lucknow and Dhakauni in Hardoi districts. More recently encouraging results have been obtained in selected villages of Hardoi district through the joint efforts of voluntary bodies and state government departments. Average yield of

paddy of over 3 tonnes per ha. were obtained from the very first year, though wheat yields in the initial year were quite low - 0.74 tonnes per ha. in the first year and 1.28 tonnes per ha. in the second year.¹

According to a study based on official data the total area of alkali affected soils in 16 districts of U.P. was 6.58 lakh ha. out of which an area of 0.78 lakh ha. had been reclaimed by 1987-88.² The study found the pace of reclamation much faster in Punjab and Haryana.

The major obstacle in the adoption of wasteland reclamation technology is the high cost involved, which is beyond the capacity of the marginal and small farmers. NABARD has adopted the norm of Rs.13,725 per ha. including crop cultivation for financing usar reclamation in U.P. In the usar reclamation project in Hardoi the cost of reclamation was even higher at Rs.22,045 per ha., out of which Rs.11,220 was on account of initial investment and Rs.10,825 was cultivation cost of paddy - wheat - dhaincha combination.³

1. Daman Singh and Manjul Bajaj, "Usar (Sodic) Soils in Uttar Pradesh : A Case Study of Two Villages in Hardoi Districts", Economic and Political Weekly, December 24-31, 1988, p.A-184.

2. P.K. Joshi and K.K. Datta, 'Temporal and Spatial Differences in Utilizing Degraded Lands in Indo-Gangetic Region' Indian Journal of Agricultural Economics, Vol.45, No.4, October - December, 1990, p.469.

3. Daman Singh and Manjul Bajaj, op.cit, p.A-183.

Another suitable option for reclamation of wasteland is that of tree plantation. According to a report of the Forest Department, U.P. Government the initial cost of developing usar lands for tree plantation would be Rs.10,000. The plantation is expected to yield about 70 tonnes of firewood per ha. and fetch an income of Rs.28,000 after 10th year, involving an internal rate of return of about 11 per cent.¹ According to a study by Abrol and Joshi the initial cost of plantation at 1983-84 prices would amount to Rs.6,416 per ha. and over a period of 7 years one ha. of *Acacia nilotica* plantation was expected to yield a return of Rs.44,500 over an investment of Rs.18,276 and one ha. plantation of *Eucalyptus* was expected to give a return of Rs.32,000 on an investment of Rs.16,322.² Agricultural Finance Commission in 1987 estimated the cost of reclamation of wastelands for plantations at Rs.15,000 per ha. in Meerut district and Rs.13,500 in Rae Bareilly district of U.P.³ One ha. plantation was expected to give an average yield of 4 to 8 tonnes per ha. per year.

1. A.N. Chaturvedi, Firewood Farming on Degraded Lands in the Gangetic Plains, U.P. Forest Bulletin, No.50, 1985.

2. I.P. Abrol and P.K. Joshi, 'Economic Viability of Reclamation of Alkali Lands with Special Reference to Agriculture and Forestry', in Society for Promotion of Wastelands Development, op.cit., p.26.

3. Reported in R.Chambers, N.C. Saxena and Tushar Shah, To The Hands of the Poor-Water and Trees, Oxford and IBH, New Delhi, 1989, p.47.

X.6.2 Ravines

Ravines, which have devastated large area in the Central Zone, pose an even more intractable problem. Ravines are extensive systems of gullies developed along river courses. They are formed in deep alluvium where the rivers flow much lower than the surrounding table lands. Once a ravine is formed it grows by the phenomenon of saturation and slip of its head and sides. Erratic, short duration and high intensity rainfall, loose and friable nature of the soil, steep slopes and undulating terrain, high flood level are factors which contribute to the widening and deepening of the ravines. But there is no doubt that uncaring human intervention through deforestation, faulty agricultural policies, uncontrolled grazing, etc. over a prolonged period have played a role in the aggravation of the problem of ravines which is of no less consequence.

Ravines have caused extensive degradation of land in U.P. and M.P. along the banks of the rivers Yamuna, Chambal and their tributaries. No precise estimates of ravine affected area are available. According to the Working Group on Ravine Reclamation, Ministry of Home Affairs, Government of India (1972) out of the 36.69 lakh ha. of ravine area in the country 12.30 lakh ha. were to be found in U.P. and 6.83 lakh ha. in M.P. The NRSA estimate based on 1980-82 wasteland put the area of ravines and gullied land at 9.96 lakh ha. and 12.47 lakh ha. in the two states respectively. However, the latest studies of the Remote Sensing Application

Centre put it at a lower level - 1.64 lakh ha. in 20 districts of U.P. studied against a figure of 8.47 lakh ha. for these districts computed by us from NRSA wasteland map for 1980-82.

Area under ravines has been continuously expanding not only degrading valuable agricultural land but also damaging roads and railway lines and threatening village settlements. Ravines are also used as hiding places by dacoits and other anti-social elements. According to one study the area under ravines in the districts of Morena and Bhind, two of the worst affected districts of M.P., has gone up from 2.28 lakh ha. in 1943-44 to 2.34 lakh ha. in 1950-51 and 3.11 lakh ha. in 1975-76, that is an increase of about 36 per cent during 32 years.¹

The study also reported that in the Chambal division 74.1 per cent of the ravine area was under the Revenue Department, 6.1 per cent under the Forest Department and 0.7 per cent under village panchayats, while the rest 18.9 per cent was under private ownership.²

The ravines are classified according to their depth as shallow (upto 1.5 M), medium (1.5 M to 5.0 M) and deep (over 5.0 M). Of the total ravine area in the Chambal Division 23.8 per cent is reported to be under shallow ravines, 40.7 per cent under medium ravines and 35.5 per cent under deep ravines.³ Only the shallow ravines are suitable for

1. Chambal Command Area Development Authority, Economics of Ravine Erosion Control and Ravine Reclamation Programmes of Chambal Division - 1983-84, Gwalior, 1986, p.18.

2. Ibid, p.20.

3. Ibid, p.18.

reclamation for agricultural purposes. The cost of reclaiming medium and deep ravines would be prohibitive.

The problem of ravine reclamation has received attention of the authorities for long. In Etawah district of U.P. work on afforestation of ravines was taken up in the latter part of the nineteenth century. In M.P. efforts for afforestation and reclamation of ravines were initiated in the erstwhile Gwalior state in 1919 following the recommendation of the Pawar Commission. The Regional Commission on Agriculture (1929) suggested that continued afforestation of the ravine tracts should be taken up to control soil erosion. In 1945 the Government of India invited Dr. Schuhart, an American expert to suggest various soil conservation measures for the ravine lands.

After the inception of planning the problem of ravine reclamation was paid greater attention both by the state and the Central Governments. Three regional soil conservation research centres have been established by the Central Government in the ravine areas at Agra (U.P.), Kota (Rajasthan) and Valsad (Gujarat). Pilot projects on survey and reclamation of ravine lands were taken up both under the state government scheme and a centrally sponsored scheme. Till 1970-71 ravine afforestation work was taken up in the state sector schemes over 2.38 lakh ha. area in U.P. and 5.98 lakh ha. area in M.P. and 3.10 lakh ha. area was reclaimed for agriculture in M.P.¹

1. Report of the National Commission on Agriculture, 1976, Part V, Resource Development, Government of India, New Delhi, p.193.

Greater attention to the problem of ravine reclamation was provided when a Working Group on Ravine Reclamation was set up by the Ministry of Home Affairs, Government of India. The Working Group prepared a comprehensive perspective plan covering the period from 1972-73 to 1998-99 involving an expenditure of Rs.608 crores in U.P. and Rs.430 crores in M.P.¹ Under the plan ravine control measures were to be launched to cover 7 lakh ha. area each in U.P. and M.P., while 5.47 lakh ha. area in U.P. and 4.15 lakh ha. area in M.P. was to be reclaimed for agricultural and horticultural purposes.² The National Commission on Agriculture 1976 endorsed the perspective plan prepared by the Working Group.

More recently a Working Group was set up by the Planning Commission in 1983 to formulate special area plan for dacoity prone districts of U.P., M.P. and Rajasthan. Following the recommendations of the Working Group a Central Sector Scheme was launched in 1987 with an annual provision of Rs.12 crores for ravine reclamation in 29 dacoit prone districts of the three states.

The Working Group has rightly recommended that first priority should be given to protect the table lands from the encroachment of ravines through construction of peripheral bunds, masonry outlets and check dams, land levelling and vegetative cover for safe disposal of surplus runoff water. The second priority may be given to afforestation of medium

1. Ibid, p.228.

2. Ibid, p.227.

and deep ravines and then within available resources reclamation of shallow rivers may be taken up. The strategy recommended by the Working Group is on sound lines and should be vigorously pursued. The maintenance of the physical structures created under the programme would also be of vital importance to prevent the re-emergence of the ravines.

The extension of the programmes of ravine reclamation over 25.7 lakh ha. - U.P. (6.02 lakh ha.), M.P. (13.29 lakh ha.) and Rajasthan (6.39 lakh ha.) - would be a time consuming and costly process requiring urgent coordinated efforts on the part of the concerned departments. The Working Group recommended the following unit costs for different operations:

- | | |
|---|-------------------|
| (a) Peripheral bunding including masonry outlets, check dams, etc. | Rs.1 lakh per km. |
| (b) Treatment of table lands such as bunding, levelling, etc. | Rs.2500 per ha. |
| (c) Afforestation of medium and deep ravines through areal seeding and manual planting | Rs.2750 per ha. |
| (d) Reclamation of Shallow ravines for agriculture and horticulture including irrigation facilities | Rs.8000 per ha. |

In certain situations ravine erosion control and reclamation measures have been found to be an economically paying proposition. However, as argued by the National Commission on Agriculture "ravine reclamation should receive national priority and the investment should not be denied on account of narrow or unfavourable benefit - cost ratio."¹

1. Ibid, p.195.

X.6.3 Water Logged Areas

Water logged area is that land where water is at or near the surface and water stands for most of the year, but it excludes water bodies like lakes, ponds and tanks. The high water table affects vegetation adversely. When it is within 1.5 M. of the surface, though the capacity of different crops to withstand water logging varies over a range.

The problem of water logging started emerging on a large scale in north west India during the last century with the growth of the canal system. New areas have been affected by water logging in post-Independence period when major irrigation projects were executed. Chambal and Tawa projects in M.P. and Sarda Canal in U.P. are some instances. Canals lead to the problem of water logging and subsequent salinity, through seepage as well as obstruction to the rain water run off. The problem has been further aggravated by the process of new construction of roads, railways, urban sites, etc., which have obstructed the natural flow of water. In other parts the problem of water logging is caused by the swelling of the rivers during monsoons which inundate large areas.

There are again divergent estimates of water logged area. According to one scholar the area suffering from bad surface drainage system and water logging in Punjab and U.P. taken together amount to about 13.8 lakh ha.¹ National Commission on Irrigation, 1972 gives an estimate of water

1. M. Shafi, 'The Problems of Wasteland in India', The Geographer, Vol.15, 1968, p.10.

logged area of 8.10 lakh ha. for U.P. and 0.57 lakh ha. in M.P. These figures were also accepted by the National Commission on Agriculture, 1976.¹ NRSA figures show a much lower area of water logging - 2.20 lakh ha. in U.P. and nil in M.P. On the other hand the Remote Sensing Application Centre, Lucknow studies based on 1986 land sat imagery give a figure of 77,159 ha. under water logged or marshy area.

The solution of water logging requires proper drainage. A combination of measures like surface or sub-surface drainage and conjunctive use of ground water water can be effective in removing water logging. Lining of canals is also a desirable but economically costly remedy to check the seepage problem. Cultivation of water resistant crops in areas with high water table or subject to flooding should be encouraged.

X.6.4 Other Types of Wastelands

The major part of cultivable wastelands in the Central Zone falls in the three categories - salt affected lands, ravinous lands and water logged lands - discussed above. Briefly attention may now be paid to certain other types of wastelands found in the zone.

X.6.4.1 Undulating Uplands

These constitute a major category of wastelands in M.P. covering over 10 lakh ha. area, though these occur on a

1. Op.cit., p.224.

limited scale in U.P. This land is generally prone to deterioration due to erosion and may or may not have scrub cover. These areas require soil conservation measures and can be utilized for social forestry purposes. Control on grazing would be necessary in these areas for rejuvenation of vegetation.

X.6.4.2 Shifting Cultivation

The problem of jhum or shifting cultivation is not extensive in the zone. About 61,000 ha. in U.P. and 2,90,000 ha. in M.P. fall under this category as per NRSA estimates. Forest Survey of India reports that 1,25,000 ha. area has been under shifting cultivation in M.P. while 12,500 ha. are put under shifting cultivation annually. To prevent the ill effects of shifting cultivation on the ecology efforts are required to minimize the practice by settling the tribal people resorting to shifting cultivation on reclaimed wastelands and putting the affected area under suitable land use like commercial forestry, agri-silvicultural uses, plantations, etc. which can provide alternative employment to the affected people.

X.6.4.3 Land Infested with Shrubs and Bushes

Considerable area is rendered waste due to infestation by deep rooted grasses and weeds. In M.P. 6.87 lakh ha. area falls in this category.¹ In U.P. also there are large areas thus affected though no estimates are available. These

1. National Commission on Agriculture, 1976, Part V, Resource Development, p.188

wastelands can be converted for use for growing fuelwood, fodder crops, grasses, etc. by use of heavy tractors to uproot the weeds and level the land.

X.6.4.4 Riverine Lands

The meandering flow of the Himalayan rivers carrying heavy sediment loads have affected large areas along the river beds. In U.P. about 15 lakh ha. are reported to be under such areas called khadar or diara¹. Reclamation of these lands will require canalization of the river flow, which should form part of the masterplan for flood and water control of the rivers.

X.6.4.5 The Himalayan Wastelands

In the Himalayan region there are steep slopes and meadows on high altitude which are subject to heavy soil erosion. These need to be put under suitable grasses and trees.

X.6.4.6 Mining and Industrial Wastelands

Mining operations and discharge of industrial effluents also cause land deterioration. No precise estimates of such wastelands are, however, available. The number of operating mines is reported to be 109 in U.P. and 580 in M.P. Mining and industrial activity has undesirable impact on land use and environment through land degradation, deforestation, land slides, soil erosion, dumping of wastes, disruption of water

1. Ibid, p.196

regimes, etc. Lime quarrying on Siwalik hills in Dehradun and open cast coal mining are some of the well known examples of such damage. Efforts are, therefore, required to identify such areas and take suitable steps for their reclamation and control mining and industrial activities from causing such damage in future.

X.7 Approach to Wasteland Development

The existence of the wasteland constitutes a wasted economic potential of enormous significance. When restored to health by proper reclamation technology each hectare of wasteland can yield 3 to 5 tonnes of foodgrains per year. Alternatively it can yield between 59 and 101 tonnes of fuelwood per year.¹ In addition to supplying foodgrains and fuelwood wastelands can be used to augment the supply of straw, green fodder, grass, etc. for animal feed which are in great shortage. At the same time wasteland development would help in generating more income and employment for the marginal farmers and the landless labourers. Of no less significance would be the contribution of wasteland development towards the restoration of ecological balance and prevention of soil erosion.

Though measures for wasteland reclamation were introduced under the various Five Year Plans right from the beginning, the progress was quite slow. The National Commission on Agriculture, 1976 looked at the problem of land

1. Society for Promotion of Wastelands Development, Economics of Wastelands Development, New Delhi, 1984, p.110.

reclamation and development in all its dimensions and made valuable suggestions in this regard. Since then the awareness of the need of wasteland development has grown tremendously in the country culminating in the setting up of the National Wasteland Development Board in 1985. The programme of wasteland development received a much needed boost since then. However, the achievements in this direction have been far from satisfactory so far even in terms of the targets fixed. Much still remains to be done in the field. In the following paragraphs we have briefly outlined the requirements of the strategy of wasteland development in future.

The first requirement is the correct identification of the magnitude and location of various types of wastelands. The various estimates available diverge from each other considerably. The recent NRSA studies have covered only a limited number of districts and need to be extended to other districts and reconciled at the field level. In fact, what is needed is a detailed mapping of land capability at the micro level.

The basic objectives of the wasteland development have to be properly understood. The primary consideration has to be the restoration of the environmental balance rather than more production of foodgrains. It is in this context that the tendency of the state governments to distribute the wastelands to landless labourers in tiny pieces for cultivation purposes has to be held in restrain. Instead the aim should be to utilize the available wastelands according

to the capability of the land, with due regard to environmental aspects. We are of the strong opinion that priority in wasteland development has to be given to afforestation and social and farm forestry so as to extend the forest coverage to the required minimum level and meet fuelwood and fodder needs of the local residents. The landless should also be encouraged to take to tree plantations rather than cultivation on the allotted land. Cultivation on wastelands may be permitted only when soil, climate, location, etc. are fully favourable for the purpose.

For drawing programmes of wasteland development the ownership pattern of the wasteland has to be kept in mind. However, there is precious little information available on this aspect. According to one study bulk of the non-forest degraded land is under private ownership as shown in Table X.5. In a study of a few villages in Sultanpur district we found that nearly 85 per cent of the wastelands were under private ownership while 15 per cent were the village common lands.¹ Considerable area of common wastelands have already been allotted to the landless by the state governments.

Since the cost of reclamation are quite high and cannot be afforded by the large number of small and marginal farmers who own a large part of the wasteland, the government has to provide adequate subsidies and arrange for the required credit and other inputs as well as technological know-how to

1. A.K. Singh, D.K. Bajpai and P.S. Garia, Socio-Economic Survey of Selected Villages in Sultanpur District, Giri Institute of Development Studies, Lucknow, 1991 (Mimeo.).

the farmers. The chances of success are greater when the various government departments work in collaboration with the NGOs as done in the Hardoi project and elsewhere. ¹

Table X.5

Ownership of Degraded Land in the Central Zone

State	Area of Degraded Lands in Million Ha.			
	Private	Forests	Revenue	Total
Uttar Pradesh	2.9(60.4)	1.4(29.2)	0.5(10.4)	4.8(100.0)
Madhya Pradesh	4.2(30.2)	7.2(51.8)	2.5(18.0)	13.9(100.0)

Note : Figures in brackets show percent to total degraded land.

Source : R.Chambers, N.C. Saxena, T.Shah, To the Hands of the Poor : Water and Trees, Oxford & IBH Publishing Co.Pvt. Ltd., New Delhi, 1989, p.45

Since the process of land degradation is closely connected with irrigation practices and soil erosion wasteland development programmes have to be closely integrated with the programmes related to irrigation, soil and water conservation as well as afforestation programmes. Thus, a large number of departments including those of agriculture, irrigation, forest have to work in close conjunction for ensuring wasteland reclamation and development on an enduring basis.

Finally, the wasteland development programme cannot be successful without the active participation of the village communities. On the one hand they have to be provided the

1. Daman Singh & Manjul Bajaj, op.cit.

required technical knowledge and inputs for wasteland development, whether on the private or common lands and on the other hand they have to be involved in the development of the common lands and their proper preservation and protection from grazing, theft, etc. One of the necessary condition for peoples' participation in this task would be to ensure that they preceive a close link between their efforts and the fulfilment of their urgent needs of fuelwood and fodder.

Appendix X.1(i)

Waste Land in U.P. As Per Land Sat Imagery 1980-82

(Area in Sq.Km.)

Districts	Salt Affected Land	Gullied or Ravinous Land	Water Logging	Undulating Upland	Jhum or Forest Blank	Sandy Area	Total Culturable waste-land	Total Non-Culturable Waste-land	Total Waste-land	% of Waste-land to Total Area
Agra	57.5	997.0	-	-	-	-	1054.5	-	1054.5	21.9
Aligarh	497.0	-	20.5	-	-	-	517.5	-	517.5	10.3
Bareilly	130.5	-	-	-	-	-	130.5	-	130.5	3.2
Bijnor	22.0	-	-	-	-	88.0	110.0	-	110.0	2.3
Budaun	101.5	-	-	-	-	563.5	665.0	-	665.0	12.8
Bulandshahr	489.0	-	-	-	-	-	489.0	-	489.0	11.2
Etah	494.5	-	20.5	-	-	-	515.0	-	515.0	11.6
Etawah	386.0	880.0	8.0	-	-	-	1274.0	-	1274.0	29.4
Farrukhabad	420.0	-	-	-	-	-	420.0	-	420.0	9.8
Ghaziabad	145.0	-	-	-	-	-	145.0	-	145.0	5.6
Meerut	61.5	-	-	-	-	-	61.5	-	61.5	1.6
Mainpuri	746.0	188.0	-	-	-	-	934.0	-	934.0	21.5
Mathura	103.0	397.0	-	-	-	-	500.0	-	500.0	13.1
Moradabad	146.5	-	-	-	-	485.5	632.0	-	632.0	10.6
Muzaffarnagar	76.0	-	-	-	-	-	76.0	-	76.0	1.8
Pilibhit	-	-	11.5	-	38.5	18.5	68.5	-	68.5	1.9
Rampur	18.0	-	-	-	-	-	18.0	-	18.0	0.7
Saharanpur	29.5	-	40.0	-	-	-	69.5	-	69.5	1.2
Shahjahanpur	50.5	-	51.0	-	-	-	101.5	-	101.5	2.2
Barabanki	151.7	-	40.7	-	-	-	192.4	-	192.4	4.3
Fatehpur	426.6	335.5	25.0	-	-	-	787.1	-	787.1	18.9
Hardoi	219.5	-	221.5	-	-	-	441.0	-	441.0	7.3
Kanpur	350.0	853.0	28.0	-	-	-	1231.0	-	1231.0	19.9
Lakhimpur Kheri	-	-	103.2	-	80.2	118.4	301.7	-	301.7	3.9
Lucknow	215.9	-	25.5	-	-	-	241.4	-	241.4	9.5
Rae Bareli	885.5	-	23.6	-	-	-	909.1	-	909.1	19.7
Sitapur	-	-	309.5	-	-	-	309.5	-	309.5	5.4
Unnao	559.5	-	88.5	-	-	-	648.0	-	648.0	14.2
Allahabad	519.0	195.0	20.6	117.0	-	-	851.6	398.2	1249.9	17.2
Azamgarh	1063.3	-	25.7	-	-	-	1089.1	-	1089.1	18.9
Bahraich	-	-	239.1	-	13.8	-	252.8	-	252.8	3.7
Ballia	271.1	-	-	-	-	-	271.1	-	271.1	8.5

contd....

Appendix X.1(i) (contd....)

Basti	-	-	150.5	-	-	-	150.5	-	150.5	2.1
Deoria	-	-	342.5	-	-	-	342.5	-	342.5	6.3
Faizabad	441.2	-	35.5	-	-	-	476.7	-	476.7	10.5
Ghazipur	628.5	-	13.5	-	-	-	642.0	-	642.0	19.0
Gonda	-	-	151.2	-	-	-	151.2	-	151.2	2.1
Gorakhpur	79.0	-	161.7	-	-	-	240.7	-	240.7	3.8
Jaunpur	864.5	-	30.8	-	-	-	895.3	-	895.3	22.2
Mirzapur	7.0	54.0	-	653.3	-	-	714.2	-	714.2	6.3
Pratapgarh	842.9	-	3.8	-	-	-	846.6	-	846.6	22.8
Sultanpur	700.0	-	17.8	-	-	-	717.7	-	717.7	16.2
Varanasi	580.8	-	22.0	1.3	-	-	604.0	-	604.0	11.9
Almora	-	-	-	-	133.5	-	133.5	433.0	566.5	10.5
Chamoli	-	-	-	-	36.5	-	36.5	5267.0	5303.5	58.1
Dehradun	-	-	-	-	-	-	-	-	-	-
Nainital	-	-	-	-	116.5	-	116.5	-	116.5	1.7
Pithoragarh	-	-	-	-	45.5	-	45.5	4282.0	4327.5	48.9
Pauri Garhwal	-	-	-	-	99.5	-	99.5	-	99.5	19.3
Tehri Garhwal	-	-	-	-	47.5	-	47.5	381.5	429.0	9.7
Uttar Kashi	-	-	-	-	11.5	-	11.5	3336.5	3348.0	41.8
Banda	-	1002.5	-	-	-	-	1002.5	408.5	1411.0	18.5
Hamirpur	-	2138.0	-	-	-	-	2138.0	-	2138.0	29.8
Jalaun	-	1282.0	-	-	-	-	1282.0	98.5	1380.5	30.2
Jhansi	-	1188.5	-	62.5	-	-	1251.0	294.5	1545.5	30.8
Lalitpur	-	413.0	-	327.3	-	-	740.3	179.3	919.5	18.3
UTTAR PRADESH	12779.6	9923.5	2231.9	1161.3	623.0	1273.8	27993.2	15079.0	43072.2	14.6

Source : Calculated from NRSA Map of Wasteland for U.P., 1980-82.

Appendix X.1(ii)

Waste Land in M.P. As Per Land Sat Imagery 1980-82

(Area in Sq.Km.)

Districts	Salt Affected Land	Gullied or Ravines Land	Water Logging	Undulating Upland	Jhum or Forest Blank	Sandy Area	Total Culturable waste-land	Total Non-Culturable Waste-land	Total Waste-land	% of Waste-land to Total Area
Balaghat	-	63.0	-	60.0	140.0	-	263.0	-	263.0	2.83
Bastar	-	-	-	238.0	378.0	-	616.0	48.0	664.0	1.69
Betul	-	-	-	68.0	191.0	-	259.0	18.0	277.0	2.76
Bhind	-	1069.0	-	-	-	-	1069.0	-	1069.0	23.97
Bhopal	-	25.0	-	24.0	-	-	49.0	167.0	216.0	7.79
Bilaspur	-	-	-	968.0	97.0	-	1065.0	-	1065.0	5.35
Chhatarpur	-	337.0	-	191.0	26.0	-	554.0	128.0	682.0	7.85
Chindwara	-	-	-	18.0	165.0	-	183.0	19.0	202.0	1.71
Damoh	-	78.0	-	98.0	18.0	-	194.0	-	194.0	2.66
Datia	-	425.0	-	-	-	-	425.0	-	425.0	20.85
Dewas	-	202.0	-	227.0	-	-	429.0	-	429.0	6.11
Dhar	-	195.0	-	320.0	-	-	515.0	52.0	567.0	6.96
Durg	-	78.0	-	613.0	18.0	-	709.0	-	709.0	8.31
Guna	-	1448.0	-	-	165.0	-	1613.0	6.0	1619.0	14.63
Gwalior	-	176.0	-	38.0	-	-	214.0	18.0	232.0	4.45
Hoshangabad	-	318.0	-	38.0	108.0	66.0	530.0	51.0	581.0	5.79
Indore	-	179.0	-	190.0	-	-	369.0	83.0	452.0	11.60
Jabalpur	-	172.0	-	119.0	78.0	-	369.0	138.0	507.0	4.99
Jhabua	-	-	-	462.0	-	-	462.0	-	462.0	6.81
Khandwa	-	168.0	-	106.0	39.0	-	313.0	128.0	441.0	4.09

Contd.....

Appendix X.1(ii) contd...

Khargone	-	242.0	-	141.0	18.0	-	401.0	38.0	439.0	3.26
Mandsaur	-	1136.0	-	-	-	-	1136.0	250.0	1386.0	14.15
Mandla	-	12.0	-	28.0	159.0	-	199.0	-	199.0	1.50
Morena	-	1381.0	-	39.0	-	-	1420.0	63.0	1483.0	12.79
Narsinghpur	-	610.0	-	-	4.0	-	614.0	48.0	662.0	12.90
Panna	-	-	-	121.0	60.0	-	181.0	-	181.0	2.54
Raigarh	-	-	-	148.0	158.0	-	306.0	-	306.0	2.37
Raipur	-	67.0	-	786.0	239.0	-	1092.0	-	1092.0	5.14
Raisen	-	347.0	-	52.0	8.0	-	407.0	448.0	855.0	10.10
Rajgarh	-	351.0	-	108.0	-	-	459.0	28.0	487.0	15.37
Rajnandgaon	-	-	-	436.0	156.0	-	592.0	-	592.0	5.32
Ratlam	-	425.0	-	197.0	-	-	622.0	-	622.0	12.80
Rewa	-	26.0	-	822.0	-	-	848.0	233.0	1081.0	17.12
Sagar	-	501.0	-	227.0	-	-	728.0	68.0	796.0	7.76
Satna	-	-	-	387.0	26.0	-	413.0	3.0	416.0	5.55
Sehore	-	52.0	-	147.0	6.0	-	205.0	218.0	423.0	6.43
Seoni	-	11.0	-	77.0	95.0	-	183.0	-	183.0	2.09
Shahdol	-	21.0	-	401.0	173.0	-	595.0	38.0	633.0	4.51
Shajapur	-	262.0	-	760.0	-	-	1022.0	-	1022.0	16.49
Shivpuri	-	622.0	-	95.0	-	-	717.0	173.0	890.0	8.66
Shidhi	-	-	-	11.0	115.0	-	126.0	-	126.0	1.20
Surguja	-	-	-	606.0	235.0	-	841.0	69.0	910.0	4.08
Tikamgarh	-	44.0	-	253.0	-	-	297.0	188.0	485.0	9.60
Ujjain	-	730.0	-	253.0	-	-	983.0	-	983.0	16.14
Vidisha	-	618.0	-	48.0	-	-	666.0	233.0	899.0	12.20
MADHYA PRADESH	-	12391.0	-	9921.0	2875.0	66.0	25253.0	2954.0	28207.0	6.51

Source : Calculated from NRSA Map of Wasteland for M.P., 1980-82.

Appendix X.2

Wasteland Area in Selected Districts of U.P. As Per Land Sat Imagery, 1986
(Area in Sq.Km.)

Districts	Total Area of Wasteland in the Dist- rict	Gullied and/or Ravin- ous Land	Uplands With or Without Scrub	Land Affected by sali- nity/alk- alinity	Barren Rocky/ Stoney Waste land	Under Utilized/ Degraded Forest Land	Sands	Water Logged and Marshy Land	Mining/ Indus- trial Waste- Land	Steep Slop- ing Area
Agra	412.50(8.59)	263.40	67.87	22.19	42.60	10.18	4.33	2.93	-	-
Allahabad	746.77(10.28)	59.68	3.28	246.68	348.52	4.04	19.11	64.21	1.25	-
✓Azamgarh	173.85(3.03)	0.30	2.54	114.16	-	-	1.21	55.64	-	-
Etawah	509.26(11.77)	268.63	2.26	205.84	-	8.48	-	24.05	-	-
Farrukhabad	322.99(7.56)	57.30	0.40	187.95	-	-	1.36	75.98	-	-
Fatehpur	294.02(7.06)	100.35	2.05	141.77	-	-	-	49.85	-	-
Ghazipur	115.01(3.40)	1.04	2.87	94.25	-	-	-	16.85	-	-
Hamirpur	476.05(6.64)	180.07	211.62	14.55	37.24	28.52	-	-	-	4.05
Jalaun	339.52(7.44)	294.41	3.30	3.79	0.03	40.99	-	-	-	-
✓Jaunpur	253.31(6.27)	13.75	42.46	171.46	-	-	0.49	25.15	-	-
Jhansi	937.58(18.66)	129.21	690.68	6.70	66.22	44.77	-	-	-	-
Kanpur	665.44(10.77)	109.43	6.97	510.96	-	12.27	-	25.81	-	-
Lalitpur	1259.70(25.00)	-	1002.47	-	243.332	13.91	-	-	-	-
Lucknow	275.35(10.89)	-	-	225.04	-	3.53	0.44	46.34	-	-
✓Mainpuri	549.24(12.64)	38.61	-	487.43	-	1.32	5.98	15.90	-	-
✓Pratapgarh	635.73(17.10)	39.85	-	524.77	-	-	-	71.11	-	-
✓Rae Bareli	579.23(12.57)	8.69	9.28	499.13	-	-	0.28	61.85	-	-
Sultanpur	503.10(11.31)	73.00	19.11	313.07	-	-	5.24	92.68	-	-
Unnao	680.42(14.93)	-	12.21	540.38	-	-	-	127.83	-	-
Varanasi	238.51(4.67)	3.42	37.25	31.17	-	151.25	-	15.41	-	-
Total	9968.58(10.47)	1641.14	2116.62	4341.29	737.93	319.26	38.44	771.59	1.25	4.05

Source : Remote Sensing Application Centre, Lucknow.

Note : Figures in brackets show percent of wasteland to total geographical area.

Chapter XI

TOWARDS AN OPTIMUM LAND USE PLAN

XI.1 Dynamic Aspects of Land Resources

Land is a most precious resource, which is vital for the well being and sustenance of the people. Land is generally regarded as a static resource, with a completely inelastic supply. However, it would be desirable to recognize that from the point of view of its productivity and use there is a dynamic aspect of land resource as well. There is a constant interaction between man, land and technology which affects each other in a dynamic setting. Any technological change including management and institutional improvement leading to an enhancement of the productivity of land should be truly regarded as land augmenting, while neglect and mismanagement of land may lead to a deterioration in the productivity of land amounting to its virtual shrinkage. The understanding of this dynamic aspect of land resources is important for formulating appropriate strategies for the development and management of our land resources.

While the human and livestock population have been relentlessly increasing putting mounting pressures on our limited land resources, the Indian planners and the people at large have for long neglected the proper care of the land and other natural resources. The sad consequences of this neglect has been that the quality of our land resources has

been deteriorating and the overall ecological balance has been threatened. The productivity of our land resources is extremely low and a very high proportion of our land is suffering from varying degrees of degradation, while a substantial proportion is lying waste for one reason or the other.

Though over time there has been a growing realization of the need for the proper care and management of our land resources, the steps taken so far have been highly inadequate and uncoordinated. This state of affairs cannot be allowed to continue.

XI.2 Considerations in Land Use Planning

An integrated approach to the scientific management, conservation and development of our land resources, within the framework of a perspective land use plan, is the need of the hour. Given the increasing biotic pressure on our limited land resources and the various competing claims for agricultural and non-agricultural use, it is necessary to prepare a perspective plan for ensuring an optimum land use. The concept of optimum land use has both economic and environmental dimension. Considerations of economic efficiency would imply that land use is governed by the objective of maximization of the net returns to the society as a whole. Environmental considerations on the other hand

sustainability. Thus the optimum land use plan seeks to maximize the present output of bio-mass while preserving the environmental balance and ensuring sustainable development. Efforts are, therefore, required to restore the health of our already severely damaged land resources and to see that the present pattern of land use does not lead to further deterioration in the quality of land resources in future.

An appropriate land use plan has to take into account the suitability and capability of land. The suitability of land for particular use would depend on agro-climatic conditions like climate, rainfall, water regime, soils, slope, etc. Land capability on the other hand, would reflect the capacity of land to carry on a given activity on a sustained basis, without erosion and damage to its productivity. It is only at the micro level that the soil capability can be assessed and decision about land use can be taken. Therefore, any land use plan to be operationally meaningful has to go to the micro level. Thus, the micro watershed would be the most appropriate unit at the field level for devising and implementing the land use plan.

A corollary of the principle of using land according to its capability is that superior quality land is not put to a use for a purpose for which lower quality of land may be put. In particular the diversion of good agricultural land for other purposes is to be strictly prevented. At the same time the practice of putting marginal lands for cultivation purposes is also to be discouraged.

Land use plan should also try to ensure that each type

of land yields its highest existing potential. The potential productivity of land depends upon the technological as well as institutional and cultural practices. It needs no emphasis that the present productivity of our land whether under cultivation, forests or pastures is extremely low. Through a wider application of the modern technology and scientific practices, with due regard to their environmental consequences, the productivity of land can be increased several fold. Similarly an appropriate institutional framework covering aspects like size of land holdings, ownership rights, land use practices, etc. can contribute much in raising land productivity and preventing ecological damage. The move towards an optimum land use plan would be easier to the extent that we are able to raise land productivity through technological and institutional innovations.

In brief, the requirements of an optimum land use plan may be summed up as follows:

1. To meet the consumption needs of the growing population by raising resource use efficiency.
2. To restore and preserve ecological balance, ensure sustainable development and prevent further damage to the land resources.
3. To restore the productivity of degraded lands.
4. To identify the capability of land and put them under

different uses based on land capability, national needs and ecological balance.

5. To enhance the productivity of different types of land through the application of modern science and technology.

6. To devise appropriate institutional mechanism for scientific management, conservation and development of the land resources.

XI.3 Proposed Land Use Plan for the Central Zone

Given the significant variations in the type and quality of land resources and the human and environmental factors affecting land use the perspective land use plans have to be prepared in the light of the specific regional setting. The states provide an important regional and administrative unit at which integrated land use plans have to be prepared.

XI.3.1 Uttar Pradesh

The Central Zone comprising the states of Uttar Pradesh and Madhya Pradesh presents a diverse picture of land use both at the state and the sub-state levels. The state of U.P. has highly favourable conditions for agricultural development in terms of rainfall, climate, soil, etc. The biotic pressure on land is very high, with a per capita net sown area of only 0.15 acres and a density of 471 per sq.km. in 1991. According to the Census of 1991 the population of the state was 13.88 crores. According to the medium

projection of the Expert Committee on Population Projections U.P.'s population would touch the figure of 16.56 crores in 2001. According to our projections the aggregate demand for foodgrains is likely to be 6661.7 lakh tonnes in the year 2001 against the projected output of 540 lakh tonnes. The projected demand for fuelwood would be 621 lakh Cu.M. and that of timber 666.7 lakh Cu.M. The state is likely to face a very serious situation with respect to the supply of fuelwood and timber in future.

Total livestock in U.P. in 1982 was 567.36 lakhs or 198 per sq.km. At the existing rate of growth the projected livestock population would be 647.76 lakhs in 2001. There is a shortfall of 31.8 per cent in case of dry fodder, 37 per cent in case of green fodder and 776 per cent in case of concentrates. The projected demand has been worked out at 1132.8 lakh tonnes of green fodder, 731.9 lakh tonnes of dry fodder and 100.45 lakh tonnes of concentrates.

Due to the heavy and increasing biotic pressure the land resources in the state have been suffering from over use and degradation and the ecological balance has been disturbed. Thus nearly 58 per cent of the geographical area is under cultivation and another 6.4 per cent is under fallow land. Pastures and grazing land have nearly disappeared. Nearly 4 per cent area is under the category of wastelands. Forest coverage according to revenue statistics is hardly 17 per cent, while effective green cover is much less. The increasing demand for land for non-agricultural purposes is

encroaching upon valuable agricultural land.

The thrust of the land use policy in the state has to be in the direction of : (a) expansion of effective forest coverage to restore ecological balance; (b) reclamation of vast area under culturable wastelands; (c) increase in the productivity of agricultural land; (d) expansion of irrigation facilities particularly through the exploitation of groundwater resources; and, (e) preservation of good quality agricultural land from diversion to other uses.

Proposed land use for U.P. in the year 2001 AD has been worked out keeping in mind the existing land use, need for different competing uses, more productive use of land and considerations of ecological balance. Table XI.1 shows the existing and proposed land use for U.P. It is suggested that coverage of forests should be expanded by 5 percentage points, area under pastures and grazing land by 1.2 percentage points, land under miscellaneous trees and groves by 1.2 percentage points and area under cultivation by 0.8 percentage points. On the other hand, we have proposed a reduction of area under the category of barren and uncultivable land (by 1.7 percentage points), cultivable wastelands (by 2.6 percentage points), current fallows (by 2.7 percentage points) and old fallows (by 1.8 percentage points)

Table XI.1Existing and Desirable Land Use Pattern in Uttar Pradesh
(Lakh hectares)

Land Use Category	Existing Area (1985-86)	Desirable Level of Area in 2001	Shift Between 1985-2001
1. Forests	51.3 (17.2)	66.3 (22.2)	+15.0 (+5.0)
2. Barren and Uncultivable Land	11.0 (3.7)	6.0 (2.0)	-5.0 (-1.7)
3. Land put to Non-Agricultural Uses	23.9 (8.0)	26.9 (9.0)	+3.0 (1.0)
4. Culturable Wastelands	11.2 (3.8)	3.0 (1.0)	-8.2 (-2.8)
5. Permanent Pastures and Other Grazing Land	3.5 (1.2)	6.0 (2.0)	+3.0 (+0.8)
6. Land Under Miscellaneous Tree Crops and Groves	5.5 (1.8)	9.0 (3.0)	+3.5 (+1.2)
7. Current Fallows	10.9 (3.7)	3.0 (1.0)	-7.9 (-2.7)
8. Old Fallows	8.4 (2.8)	3.0 (1.0)	-5.4 (-1.8)
9. Net Sown Area	172.4 (57.9)	175.0 (58.7)	+2.6 (+0.8)
Total Reported Area	298.0 (100.0)	298.0 (100.0)	-

Note : Figures in brackets show percentage to total reported area.

The proposed changes would require a shift of 26.6 lakh ha. or 9 per cent of geographical area from one use to another over the next decade. Additional requirement of area for cultivation, grazing land and for area under trees and groves can be met by shifting area under current and old fallows for these uses. The additional area of 15 lakh ha. under forests can be obtained by transferring 8.2 lakh ha. from cultivable wastelands, 4.7 lakh ha. from old fallows

and 2.1 lakh ha. from barren and uncultivable land. Requirement of additional area under non-agricultural uses should be met by using land under barren and uncultivable category as far as possible.

The action plan for U.P. for ensuring optimum land use plan would require:

- (a) Reforestation of 34 lakh ha. under degraded forest lands;
- (b) Afforestation over an additional 15 lakh ha.;
- (c) Development of 12 lakh ha. area under permanent pastures, grazing lands, miscellaneous tree crops and old fallows by restoring their productivity as pastures, orchards, tree plantations, etc.; and,
- (d) Creation of an additional irrigation potential of 100 lakh ha. particularly through ground water exploitation.

XI.3.2 Madhya Pradesh

The state of Madhya Pradesh presents a different scenario. The state is rich in natural vegetation with one-third of area under forests. The potential for agricultural development, however, varies over different parts depending upon soil conditions, terrain and availability of irrigation facilities. Bulk of agriculture is under unirrigated conditions.

The biotic pressure on land is comparatively less, with a per capita sown area of 0.37 ha. and a density of 149 per sq. km. The population of the state in 1991 was 6.61 crores and is likely to reach 7.51 crores in 2001 as per population projections of the Expert Committee.

The aggregate projected demand for foodgrains in the state in 2001 comes to 259 lakh tonnes. The projected demand for fuelwood has been worked out at 394 lakh Cu.M. and that of timber at 27 lakhs Cu.M.

The livestock population of the state is likely to grow to 479 lakhs in 2001. There is a shortfall of 93.6 per cent in the supply of concentrates and 73.2 per cent in case of dry fodder.

The land and forest resources in the state are suffering from serious degradation. The strategy for land use planning in the state has to aim at : (a) stoppage of the process of deforestation and rejuvenation of the degraded forest lands; (b) reclamation of the large wastelands in the state; (c) proper water and soil conservation; and, (d) full exploitation of surface and ground water resources of the state.

The proposed land use pattern for M.P. in the light of the above considerations has been shown in Table XI.2 along with the existing land use.

It is suggested that the coverage of forests should be increased by 2 percentage points, area under pastures and grazing land by 0.6 percentage points, land under miscellaneous trees and groves by 1.1 percentage points and net sown area by 1 percentage point. On the other hand, we have proposed a reduction of area under barren and uncultivable land by 1 percentage point, under culturable waste by 2.6 percentage points, current fallow by 1.0 percentage point and old fallows by 1.1 percentage points.

Table XI.2

Existing and Desirable Land Use Pattern in Madhya Pradesh
(Lakh hectares)

Land Use Category	Existing Area (1982-83)	Desirable Level of Area in 2001	Shift Between 1985- 2001
1. Forests	140.2 (31.7)	146.8 (33.7)	+6.6 (+2.0)
2. Barren and Uncultivable Land	23.7 (5.4)	19.4 (4.4)	-4.3 (-1.0)
3. Land put to Non-Agricultural Uses	22.1 (5.0)	26.4 (6.0)	+4.3 (+1.0)
4. Culturable Wastelands	18.0 (4.1)	6.6 (1.5)	-11.4 (-2.6)
5. Permanent Pastures and Other Grazing Land	28.2 (6.4)	31.0 (7.0)	+2.8 (+0.6)
6. Land Under Miscellaneous Tree Crops and Groves	1.6 (0.4)	6.6 (1.5)	+5.0 (+1.1)
7. Current Fallows	8.1 (1.8)	3.7 (0.8)	-4.4 (-1.0)
8. Old Fallows	10.1 (2.3)	5.1 (1.2)	-5.0 (-1.1)
9. Net Sown Area	190.3 (43.0)	194.7 (44.0)	+4.4 (+1.0)
Total Reported Area	442.0 (100.0)	442.0 (100.0)	-

Note : Figures in brackets show percentage to total reported area.

The proposed changes would require a shift of 25 lakh ha. or 5.7 per cent of the geographical area from one use to another over the next decade. Thus 4.4 lakh ha. area should be shifted from current fallows to net area sown and 5 lakh ha. from area under old fallows to area under miscellaneous trees and groves. 11.4 lakh ha. of culturable wasteland should be reclaimed, out of which 8.6 lakh ha. should be brought under forestry and 2.8 lakh ha. under pastures and grazing land. Requirement of 4.3 lakh ha. for non-agricultural uses can be met by using land under barren and uncultivable category.

The action plan for attaining optimum land use in Madhya Pradesh would require:

- (a) Reforestation of 71 lakh ha. of degraded forest lands;
- (b) Afforestation of an additional area of 11 lakh ha.;
- (c) Development of 55 lakh ha. area under permanent pastures, grazing lands, miscellaneous tree crops and old fallows by restoring their productivity as pastures, orchards, tree plantations, etc.; and,
- (d) Creation of an additional irrigation potential of 100 lakh ha. by exploiting the undeveloped surface and ground water resources.

XI.4 Need for an Integrated Approach To Natural Resource Management

A major shortcoming in our policy towards management of natural resources has been that the policy and institutional interventions have been ad hoc, partial and uncoordinated. There is little integration between the activities of various departments and organizations dealing with land, water and forest resources. Sectoral perceptions have dominated the policy formulation. As a result we find Forest Policy Statement or Water Policy Statement rather than an overall resource development policy.

We are of the opinion that for the scientific development, management and conservation of our natural resources we have to move without loss of time in the direction of an integrated approach. The departments of forest, revenue, agriculture, irrigation, etc. have to be brought under one umbrella and their activities properly coordinated from this angle.

In particular, the point needs to be emphasized that land and water resources are interrelated in a dynamic natural setting and have to be planned together. The problems of deforestation, soil erosion, sedimentation of reservoirs, floods, waterlogging, soil salinity, etc. are closely correlated. Thus, neither land nor water can be planned in isolation. It is only by maintaining the proper balance between the land and water regimes that we can hope for a sustainable process of development.

XI.5 Institutional Requisites

An appropriate institutional framework needs to be evolved for the development, management and conservation of our land, water and other natural resources. At the Central level there is a much better awareness of this need which is reflected in the creation of bodies like the National Land Use and Conservation Board, the National Wasteland Development Board and the National Land Use and Wasteland Development Council, which acts as the apex body.

At the state level, however, the awareness of the problem has been much less even though matters pertaining to land come under the state list. Though the State Land Use Boards were set up as early as 1974 with the Chief Minister as the Chairman. However, these have been somnolent bodies and have rarely met. There is an urgent need to activate the State Land Use Boards and make them effective bodies with adequate power and resources. These Boards have to be made responsible for devising, implementing and monitoring the land use policy and suggesting a suitable legislative framework for the same in the context of the state.

The implementation of land use policy has to be operationalised through decentralized planning. At present no body exists at the district level which may look at the different aspects of land use from an integrated perspective. Considerations of land use have to be given an appropriate

place in the district development plans. A District Land Use Committee may, therefore, be created at the district level, which will operate within the direction of the District Planning Board/Committee. Apart from district level officers of the concerned departments the Committee should include representatives of farmers, N.G.O.'s working in the area and specialist from educational institutions. The Committee should be entrusted with the task of preparing and supervising the appropriate land use policy in the light of the local conditions.

As we have argued earlier the land use planning has to be based upon a micro-level assessment of the situation of the soil conditions for which micro water shed would be the most appropriate areal unit. Detailed land use plans should be prepared for such micro water sheds of approximately 1000 ha. consisting of 4-5 villages in the light of the local resources and demand thereon. For each micro watershed fuelwood and fodder budget should be prepared and areas should be demarcated according to their suitability for crop cultivation, horticulture, pastures, tree plantations, etc.

These land use plans for micro watershed have to be prepared through full participation of the village communities through the elected Panchayats. The local people have an intimate knowledge of the soil conditions and their suitability for different uses. The government agencies can provide the needed technical advice. In decisions regarding the allocation of land for different uses and the selection

of tree species and crops grown the needs and desires of the local people have to be given full weight. Unless steps are taken to meet the basic requirement of food, fodder and fuelwood of the local people no amount of legislative measures and governmental regulations can hope to be successful in stopping the degradation of land and forests. Only the community's vigilance can ensure proper protection of forests, pastures and other community lands.

Such community based institutional arrangements have existed in the country in the past. Even in the present times there are examples of successful Van Panchayats and Pani Panchayats managing collectively the forest or water resources and sharing their fruits equitably. Multiplication of such examples on a large scale is indeed a formidable organizational challenge.

The task of the government would be to provide technical knowledge and input support for scientific management of land resources by village communities. Massive awareness campaigns would be required to educate the people about the need of restoring and preserving ecological balance and pointing out the ecological consequences of their actions. Where the local landman balance is such that the basic requirements of the people cannot be met by local resources arrangement of supply of fuelwoods and fodder, etc. have to be made.

The policy interventions have to keep in mind the proprietary rights over land. As bulk of land, including

cultivated and wasteland, is under private ownership appropriate financial incentives and infrastructural support is to be provided to influence the decisions of the millions of individual land owners to direct the resource use in socially desired directions.

A large part of the demand for land for non-agricultural purposes comes from the government. Suitable guidelines need to be evolved in this context to prevent wasteful use of scarce land resources. Similarly care has to be taken to ensure that the process of urbanization and industrialization makes an economical use of scarce land and the tendency to grab more land than required is held in check. To the extent possible barren and uncultivable land should be utilized for this purpose. The principle of compensatory development of wasteland in lieu of the land provided for non-agricultural purposes to individuals, government departments and other organizations should be enforced or cost towards the same may be recovered from them.

The neglect of our precious land resources has gone on for long with disastrous consequences. The damage caused cannot be fully retrieved. The situation has assumed an urgency and cannot be allowed to continue as such any more. Proper care of our land resources is not only needed to meet the requirement of the growing population but also to arrest the threat to the ecological balance. It is only through scientific management of our natural resources that we can

hope to ensure a sustainable process of economic development.

It is a formidable challenge which must be met with determination and the sense of urgency that it deserves.

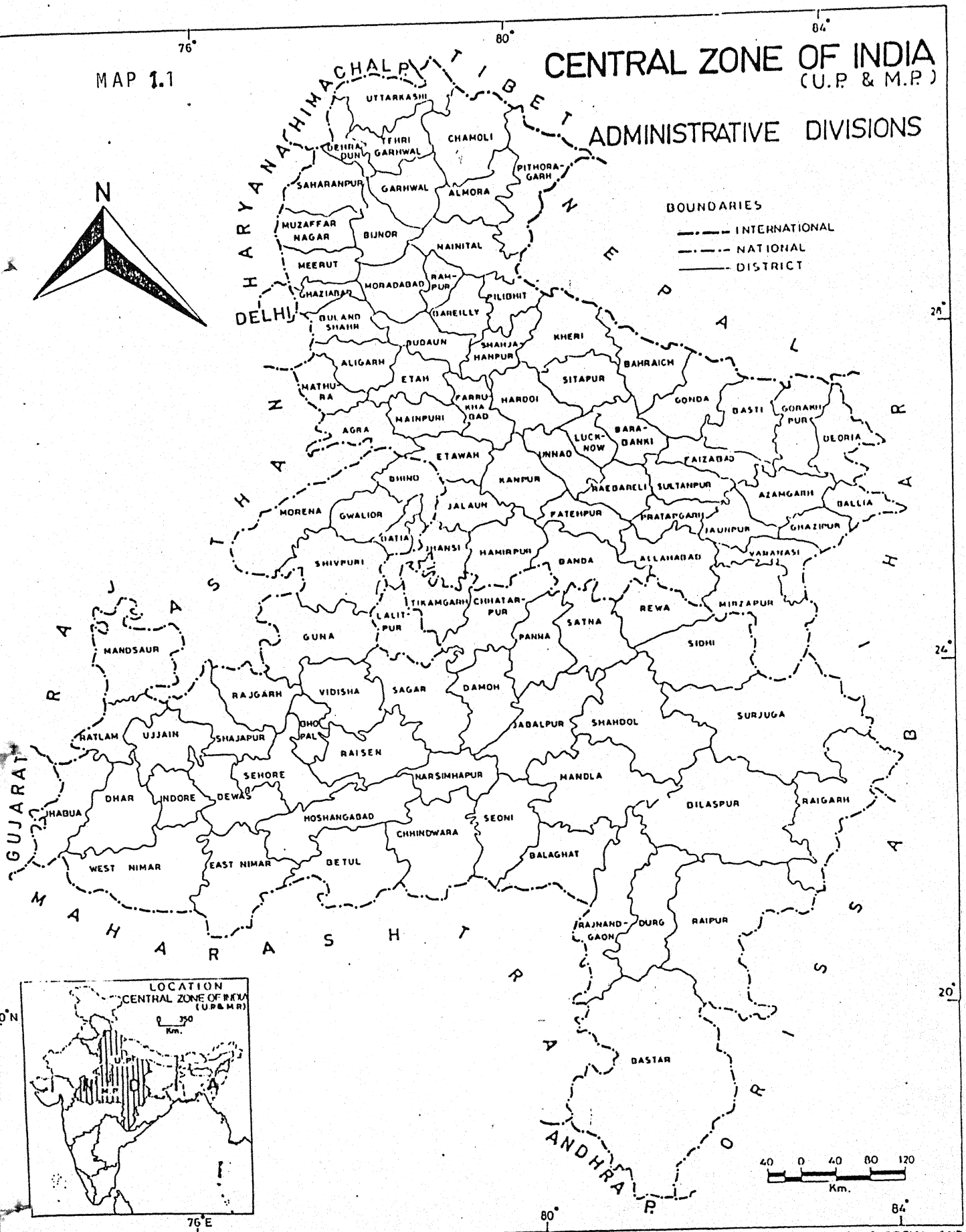
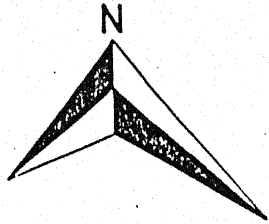
MAP 1.1

CENTRAL ZONE OF INDIA (U.P. & M.P.)

ADMINISTRATIVE DIVISIONS

BOUNDARIES

- INTERNATIONAL
- NATIONAL
- DISTRICT

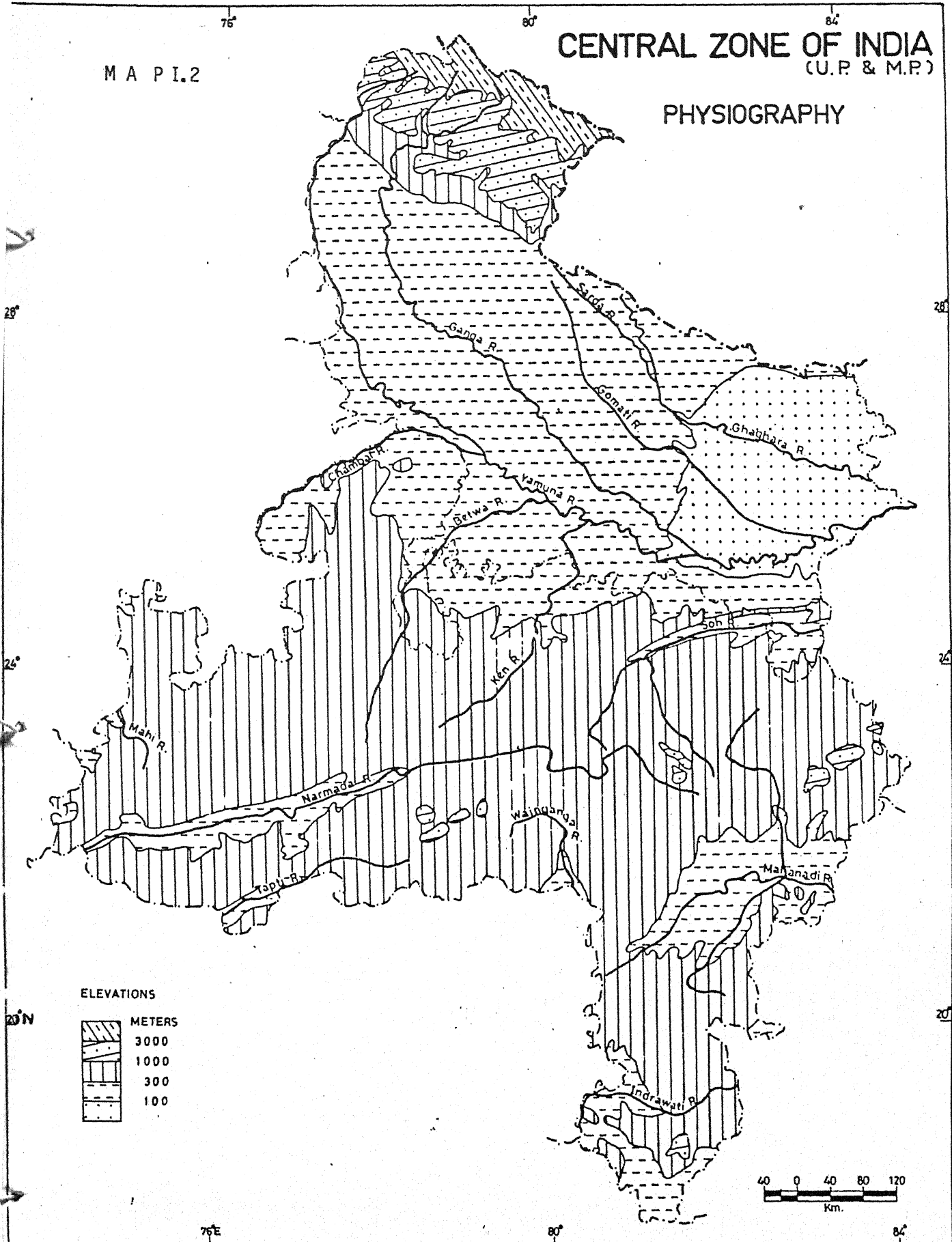


SOURCE: BASED UPON A SOCIAL AND ECONOMIC ATLAS OF INDIA, OXFORD, 1987

MAPI.2

CENTRAL ZONE OF INDIA (U.P. & M.P.)

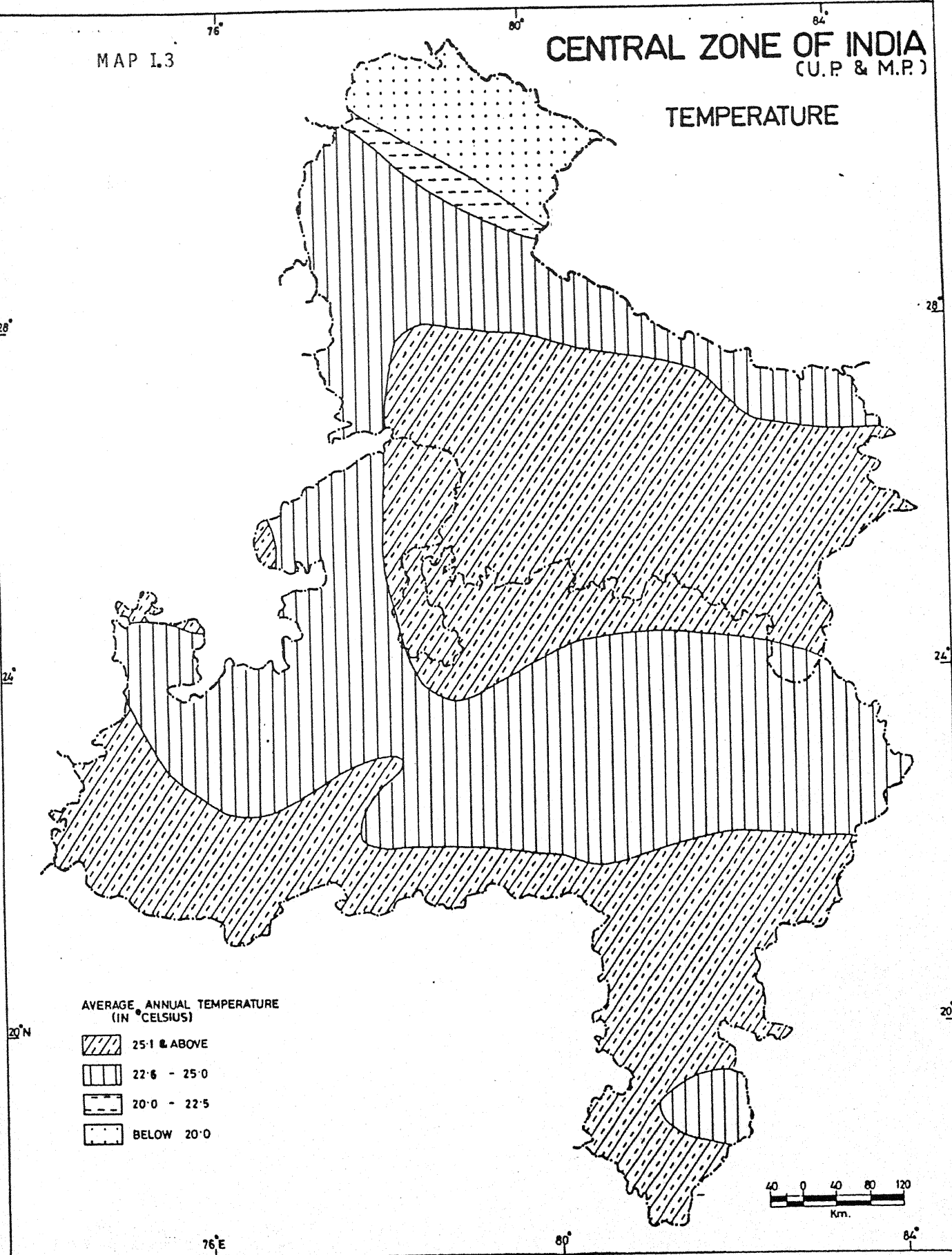
PHYSIOGRAPHY



MAP I.3

CENTRAL ZONE OF INDIA (U.P. & M.P.)

TEMPERATURE

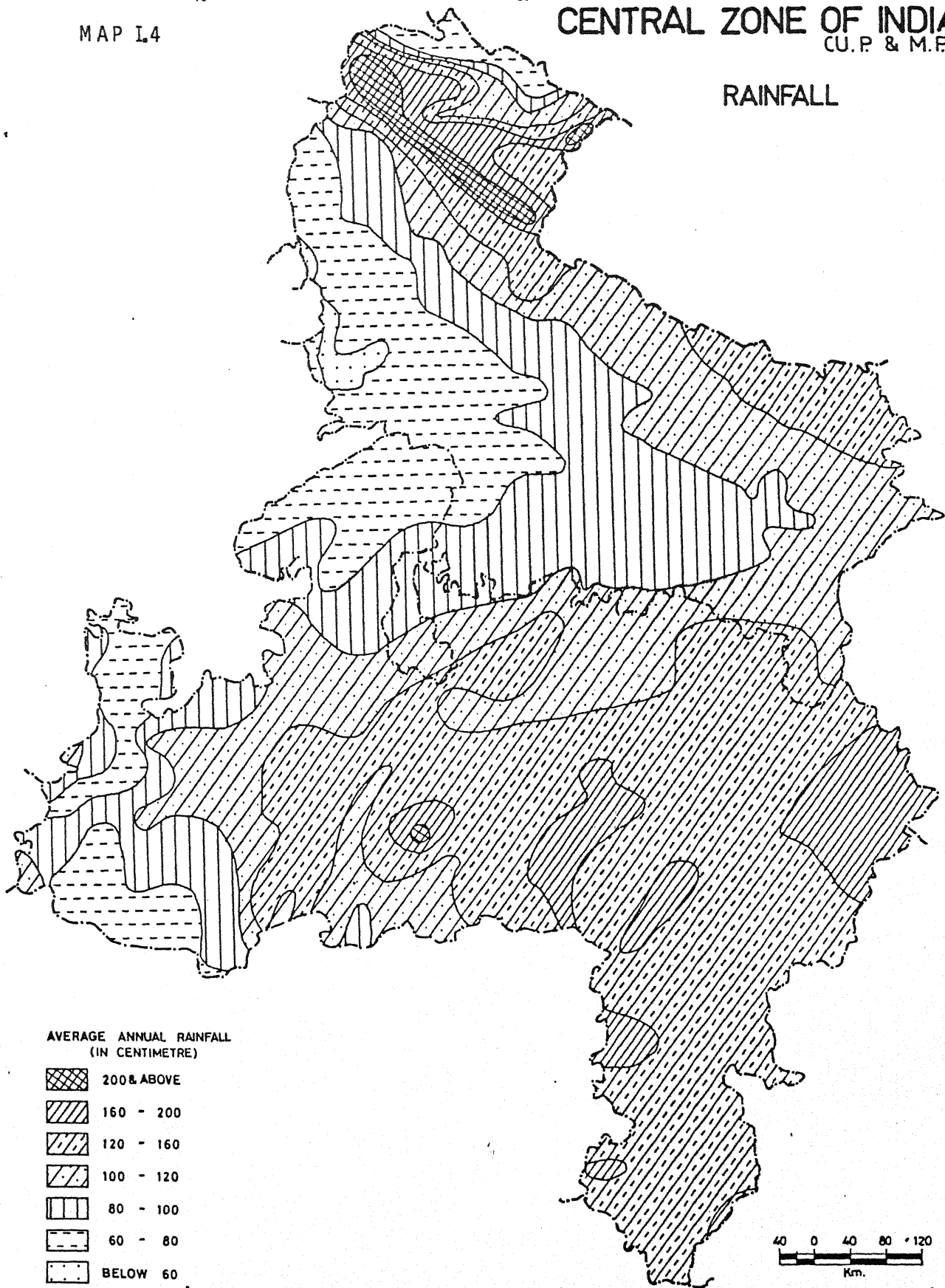


SOURCE: BASED UPON A SOCIAL AND ECONOMIC ATLAS OF INDIA, OXFORD, 1987

MAP I.4

CENTRAL ZONE OF INDIA (U.P. & M.P.)

RAINFALL

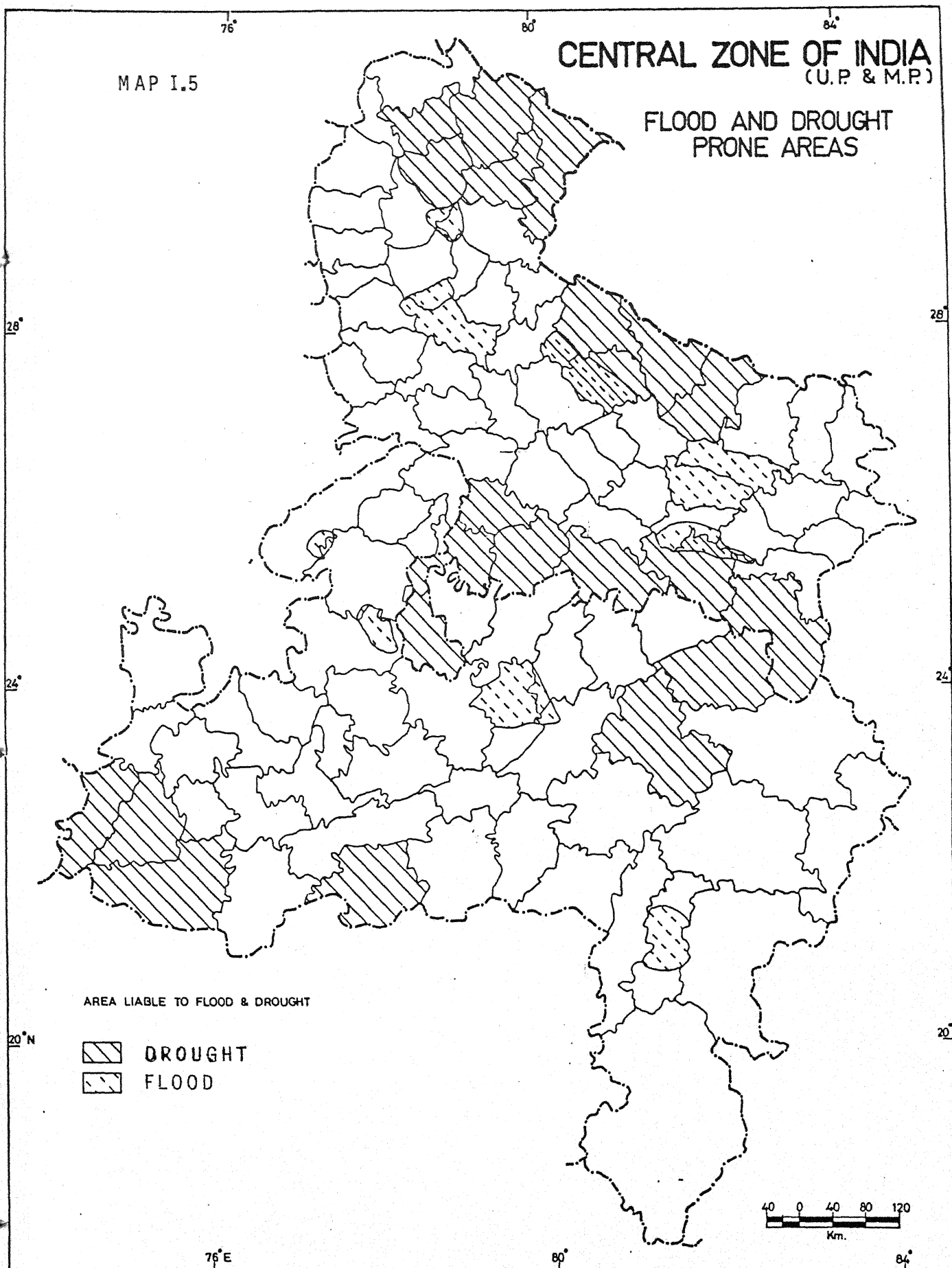


SOURCE: BASED UPON A SOCIAL AND
ECONOMIC ATLAS OF INDIA, OXFORD, 1987

MAP I.5

CENTRAL ZONE OF INDIA (U.P. & M.P.)

FLOOD AND DROUGHT PRONE AREAS

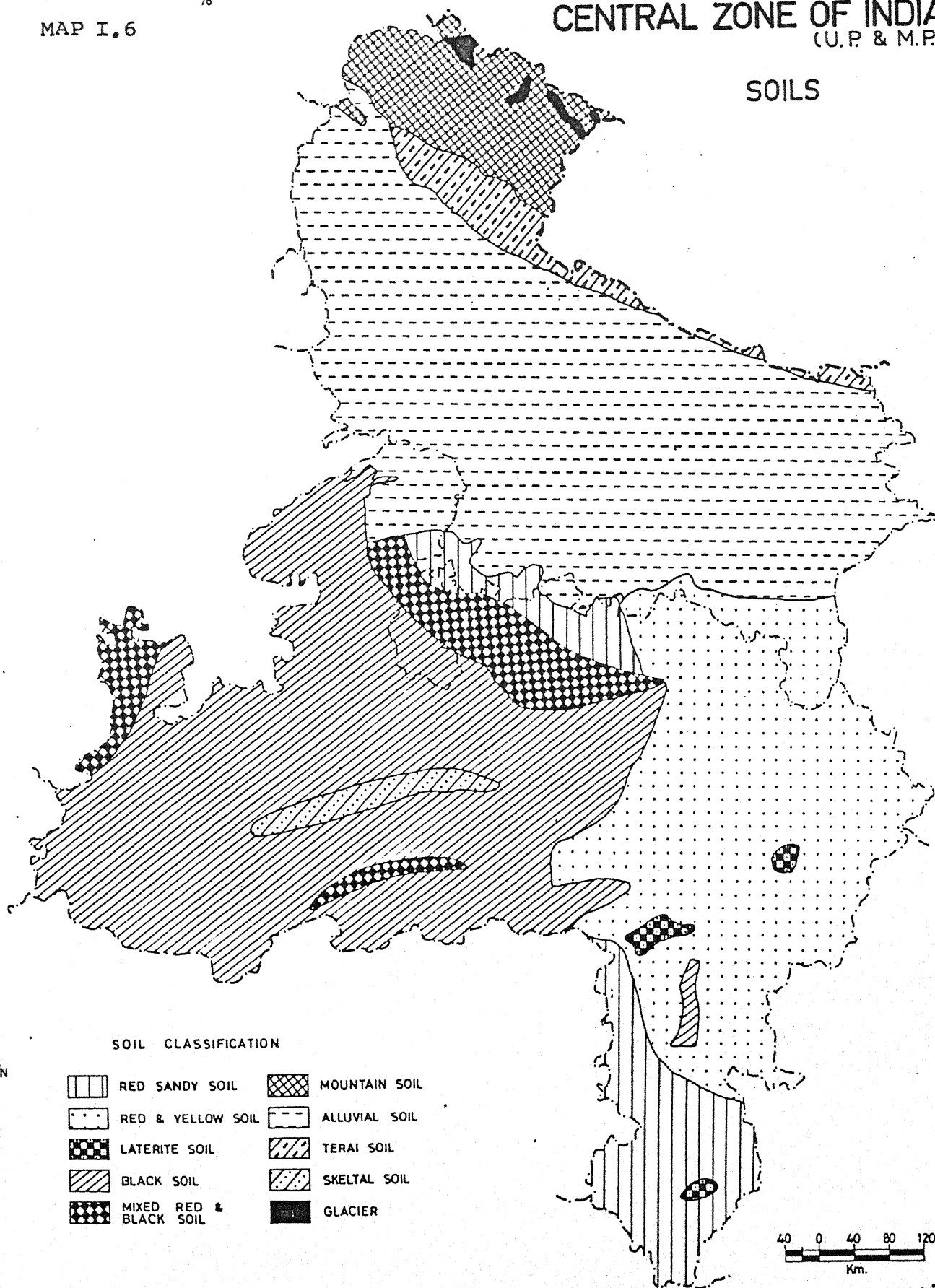


SOURCE: BASED UPON A SOCIAL AND
ECONOMIC ATLAS OF INDIA, OXFORD, 1987

MAP I.6

CENTRAL ZONE OF INDIA (U.P. & M.P.)

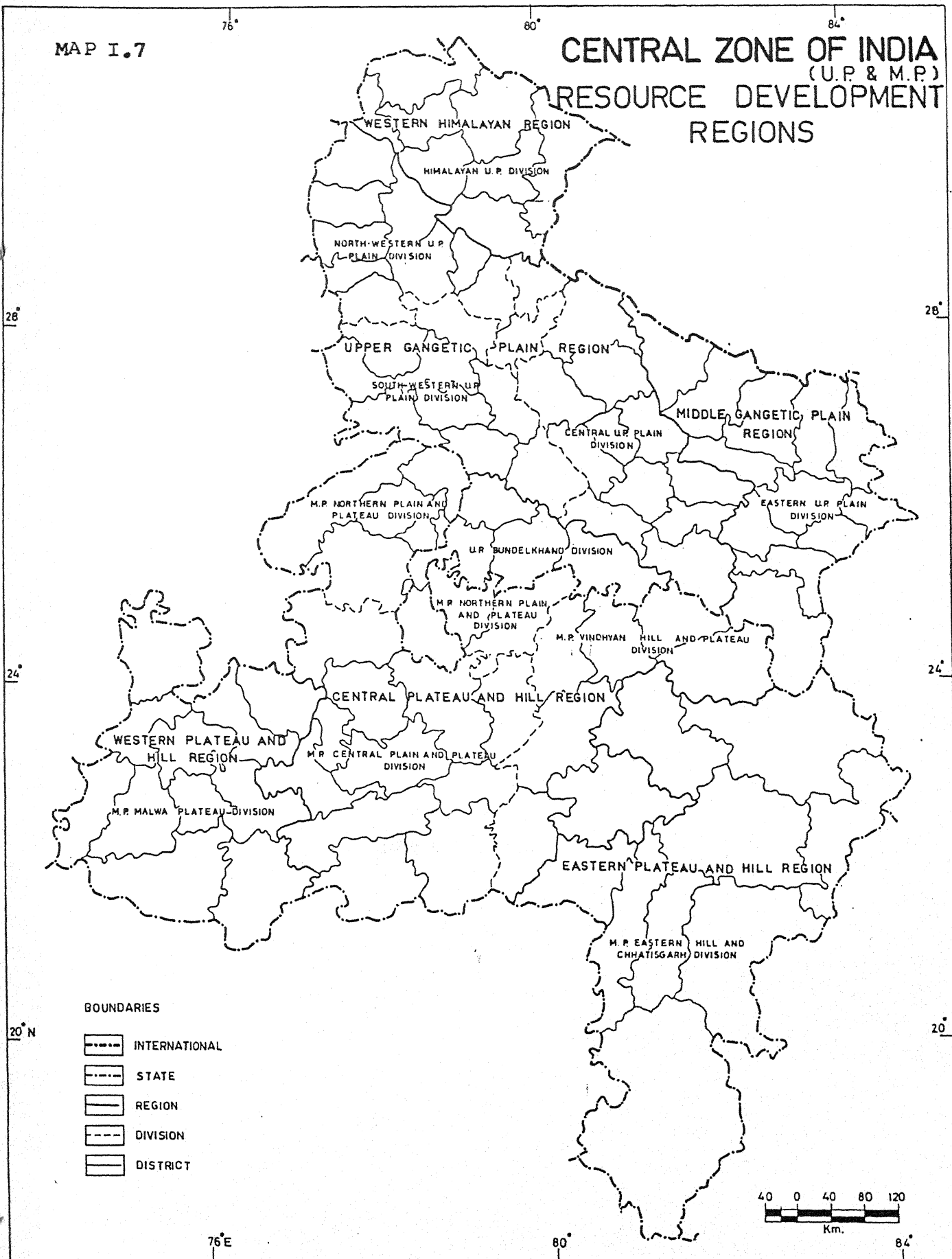
SOILS



SOURCE: BASED UPON A SOCIAL AND ECONOMIC ATLAS OF INDIA, OXFORD, 1987

MAP I.7

CENTRAL ZONE OF INDIA (U.P. & M.P.) RESOURCE DEVELOPMENT REGIONS



SOURCE: PLANNING COMMISSION, GOVT. OF INDIA

MAP II.1

CENTRAL ZONE OF INDIA

(U.P. & M.P.)

POPULATION DENSITY 1981

28°

28°

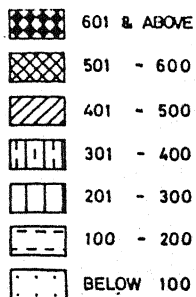
24°

24°

20°N

20°

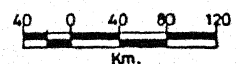
PERSONS PER KM²



76°E

80°

84°

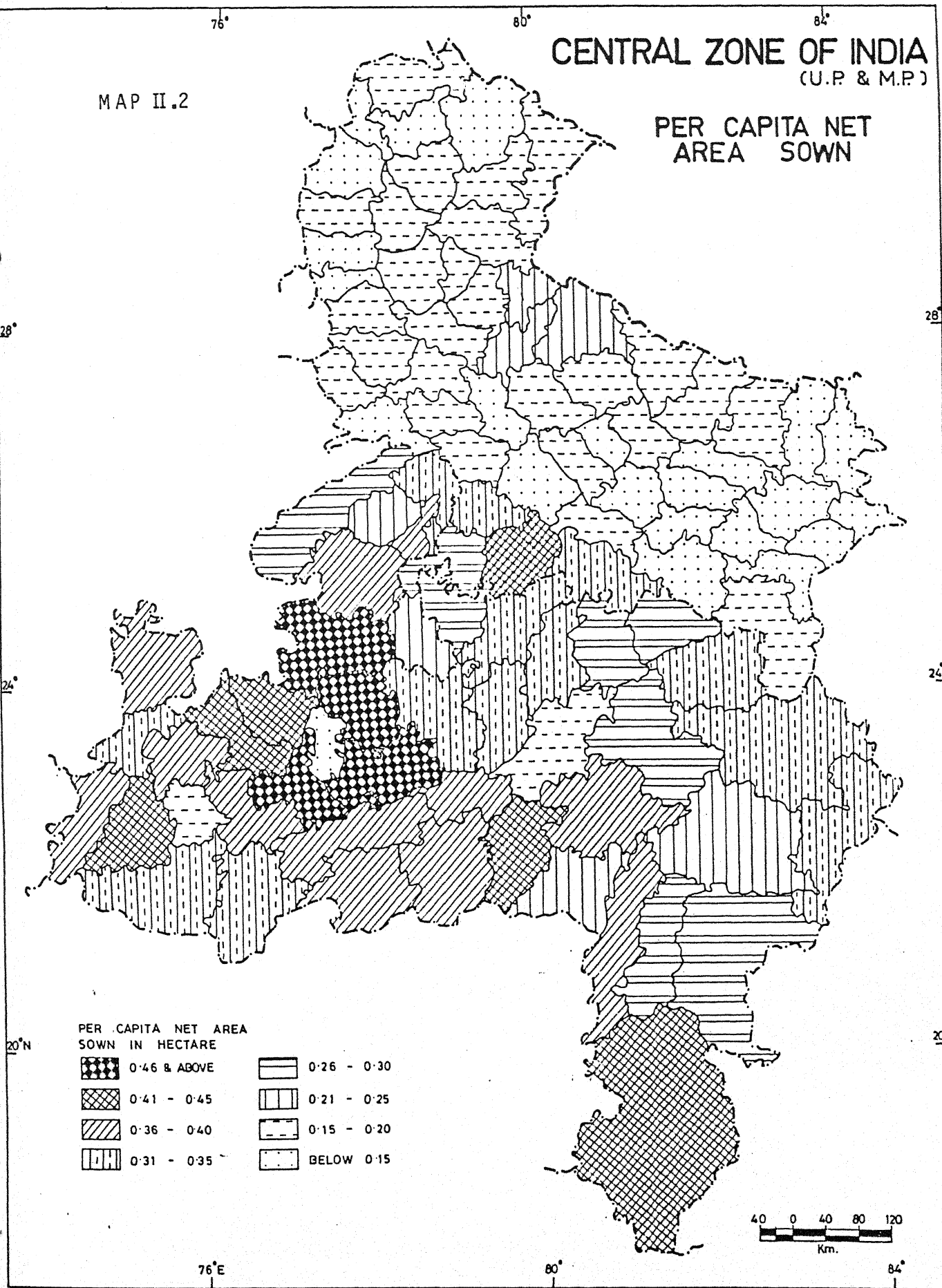


SOURCE: DATA BASED UPON CENSUS OF INDIA, 1981

MAP II.2

CENTRAL ZONE OF INDIA (U.P. & M.P.)

PER CAPITA NET
AREA SOWN

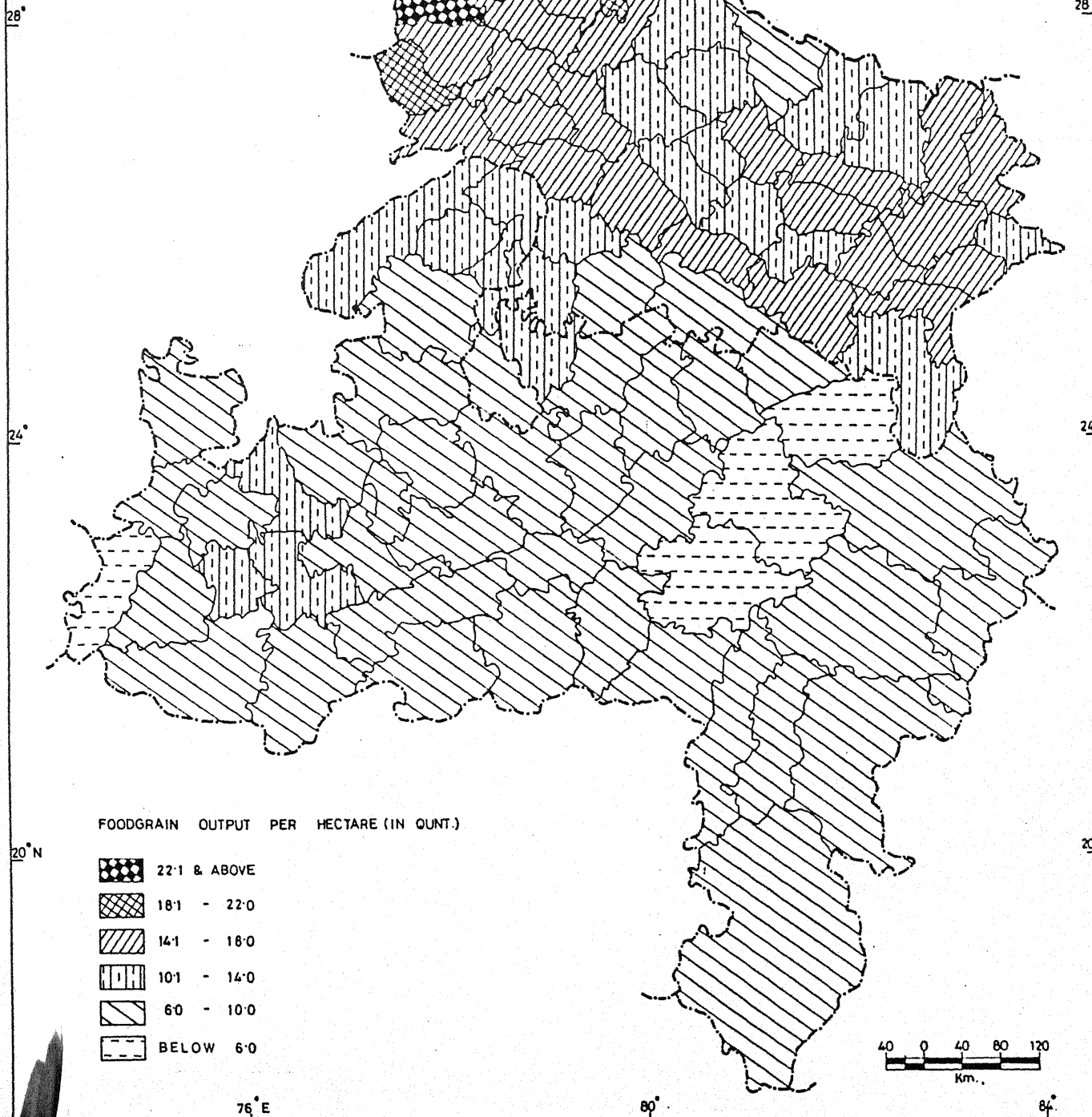


SOURCE: AVERAGE FOR 1983-84, 84-85 & 85-86
BASED UPON AGRICULTURAL STATISTICS OF U.P. & M.P.

MAP IV.1

CENTRAL ZONE OF INDIA (U.P. & M.P.)

AVERAGE YIELD OF FOODGRAINS

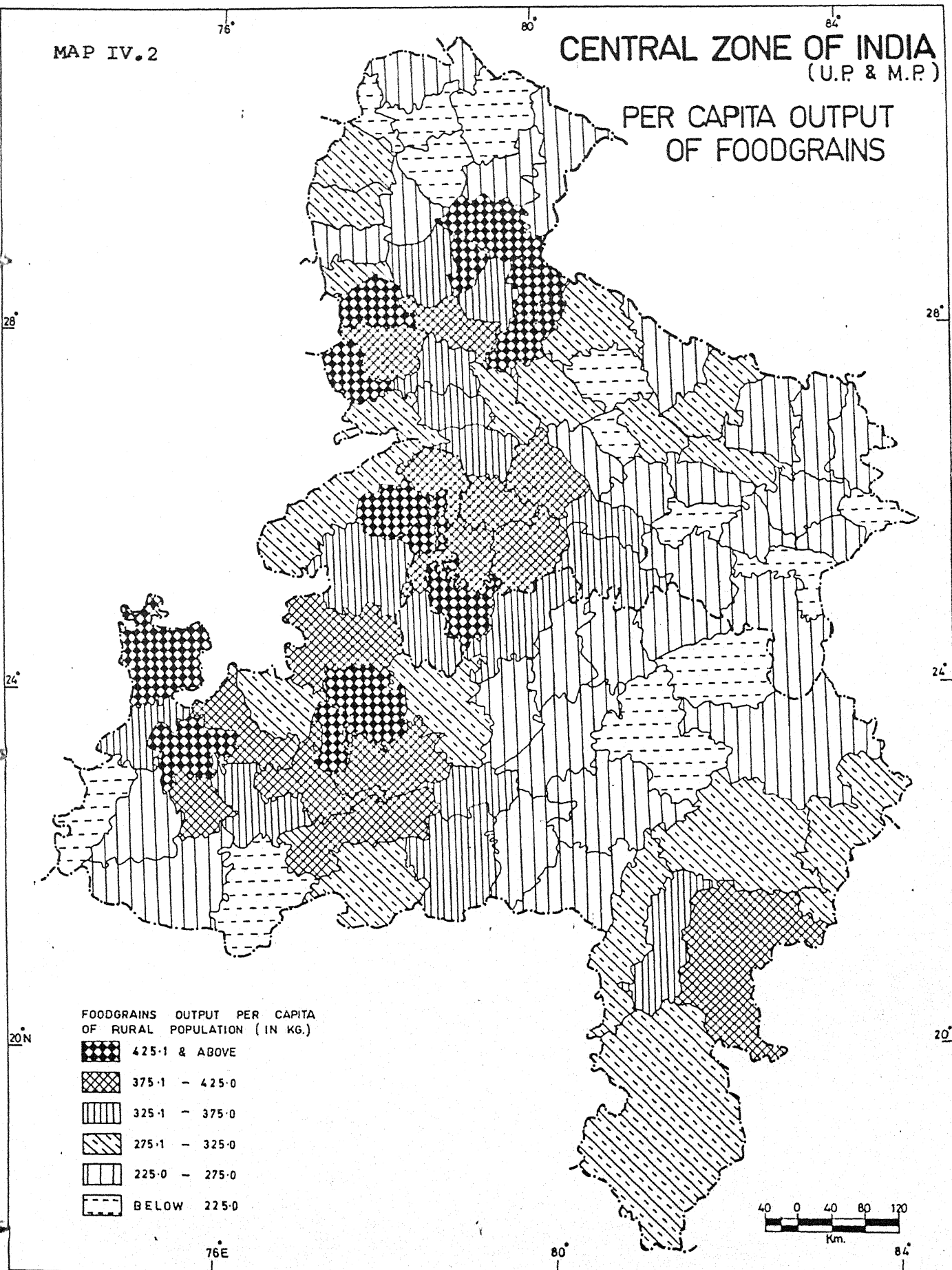


SOURCE: AVERAGE FOR 1983-84, 84-85 & 85-86
BASED UPON AGRICULTURAL STATISTICS OF U.P. & M.P.

MAP IV.2

CENTRAL ZONE OF INDIA (U.P. & M.P.)

PER CAPITA OUTPUT OF FOODGRAINS

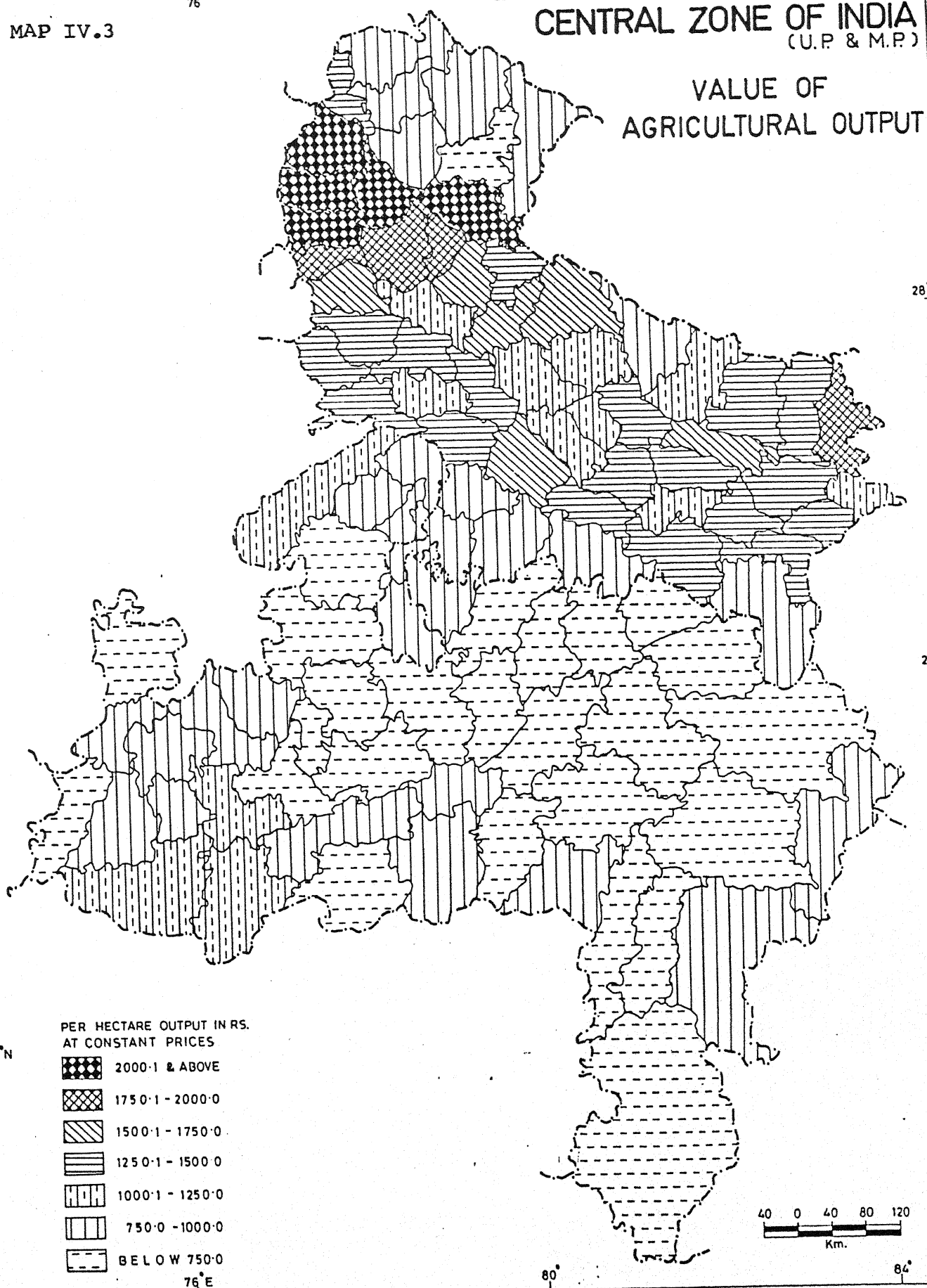


SOURCE: AVERAGE FOR 1983-84, 84-85 & 85-86
BASED UPON AGRICULTURAL STATISTICS OF U.P. & M.P.

MAP IV.3

CENTRAL ZONE OF INDIA (U.P. & M.P.)

VALUE OF AGRICULTURAL OUTPUT

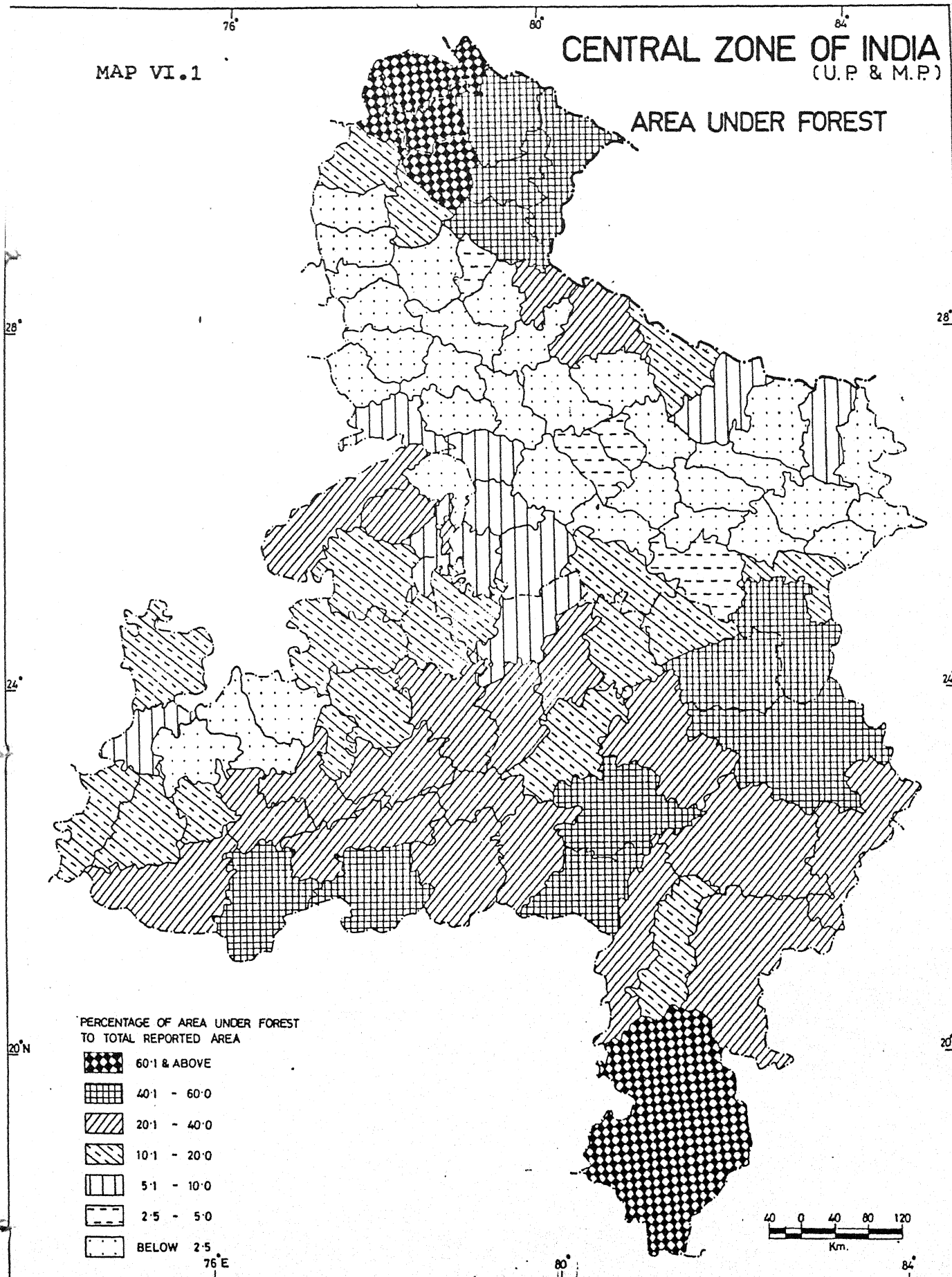


SOURCE: AVERAGE FOR 1983-84, 84-85 & 85-86
BASED UPON AGRICULTURAL STATISTICS OF U.P. & M.P.

MAP VI.1

CENTRAL ZONE OF INDIA (U.P. & M.P.)

AREA UNDER FOREST



SOURCE: AVERAGE FOR 1983-84, 84-85 & 85-86
BASED UPON AGRICULTURAL STATISTICS OF U.P. & M.P.

CENTRAL ZONE OF INDIA (U.P. & M.P.)

LAND UNDER NON AGRICULTURAL USES

28°

28°

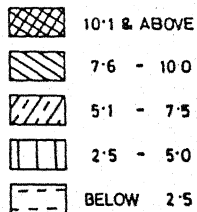
24°

24°

20° N

20°

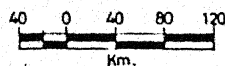
PERCENTAGE OF LAND UNDER NON AGRICULTURAL
USES TO TOTAL REPORTED AREA



76° E

80°

84°

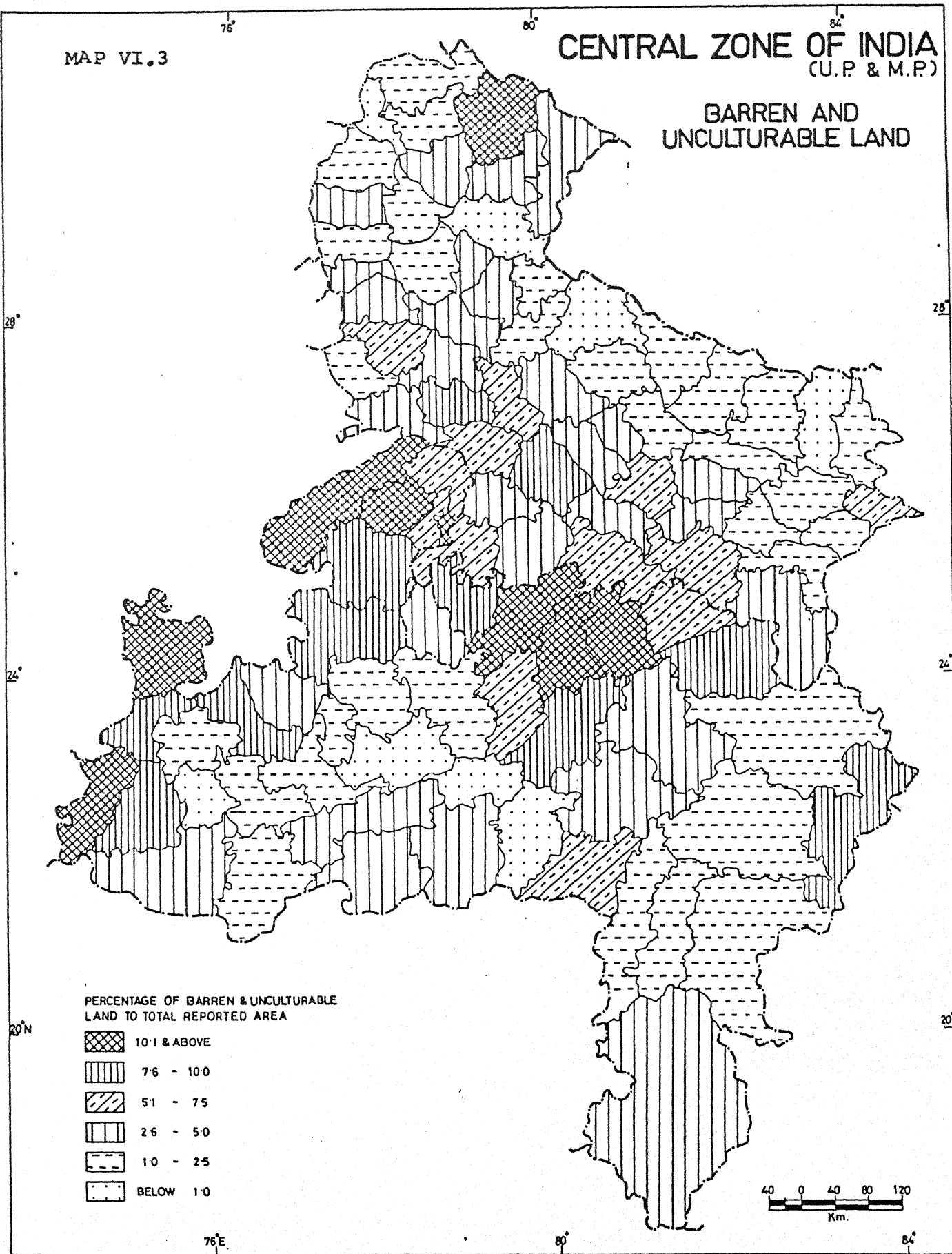


SOURCE: AVERAGE FOR 1983-84, 84-85 & 85-86
BASED UPON AGRICULTURAL STATISTICS OF U.P. & M.P.

MAP VI.3

CENTRAL ZONE OF INDIA (U.P. & M.P.)

BARREN AND UNCULTURABLE LAND

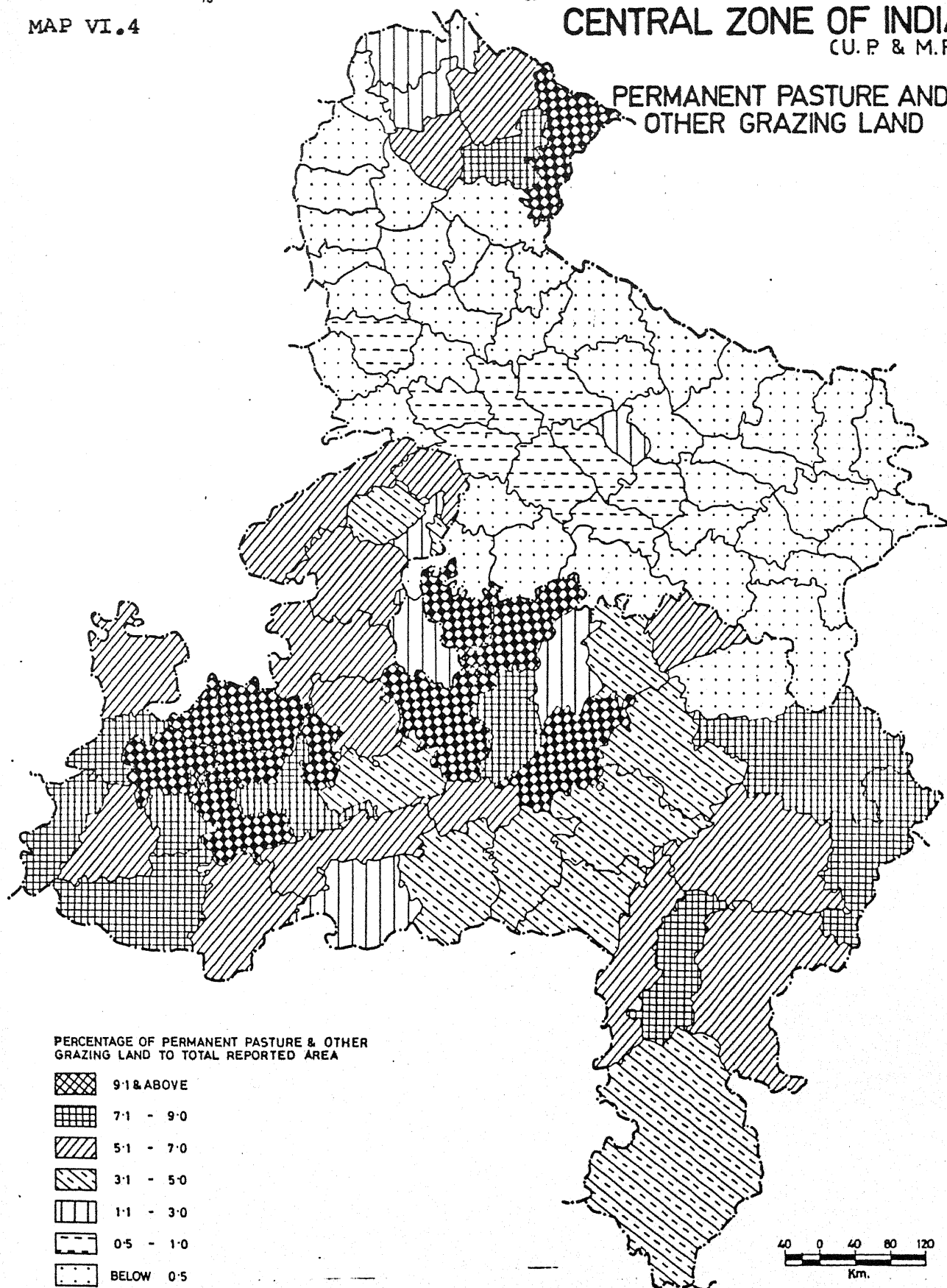


SOURCE: AVERAGE FOR 1983-84, 84-85 & 85-86
BASED UPON AGRICULTURAL STATISTICS OF U.P. & M.P.

CENTRAL ZONE OF INDIA

(U.P. & M.P.)

PERMANENT PASTURE AND
OTHER GRAZING LAND

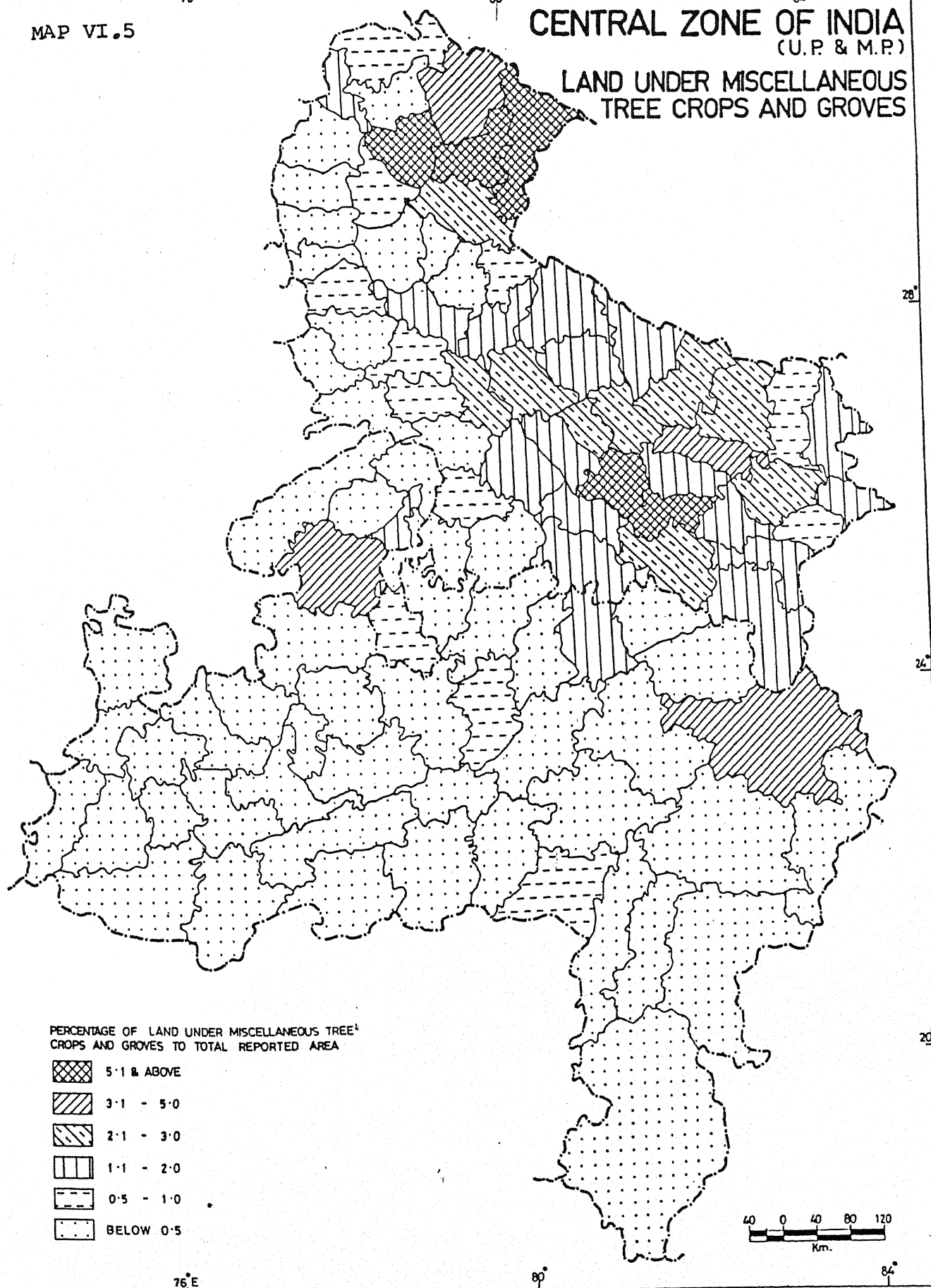


SOURCE: AVERAGE FOR 1983-84, 84-85 & 85-86
BASED UPON AGRICULTURAL STATISTICS OF U.P. & M.P.

MAP VI.5

CENTRAL ZONE OF INDIA (U.P. & M.P.)

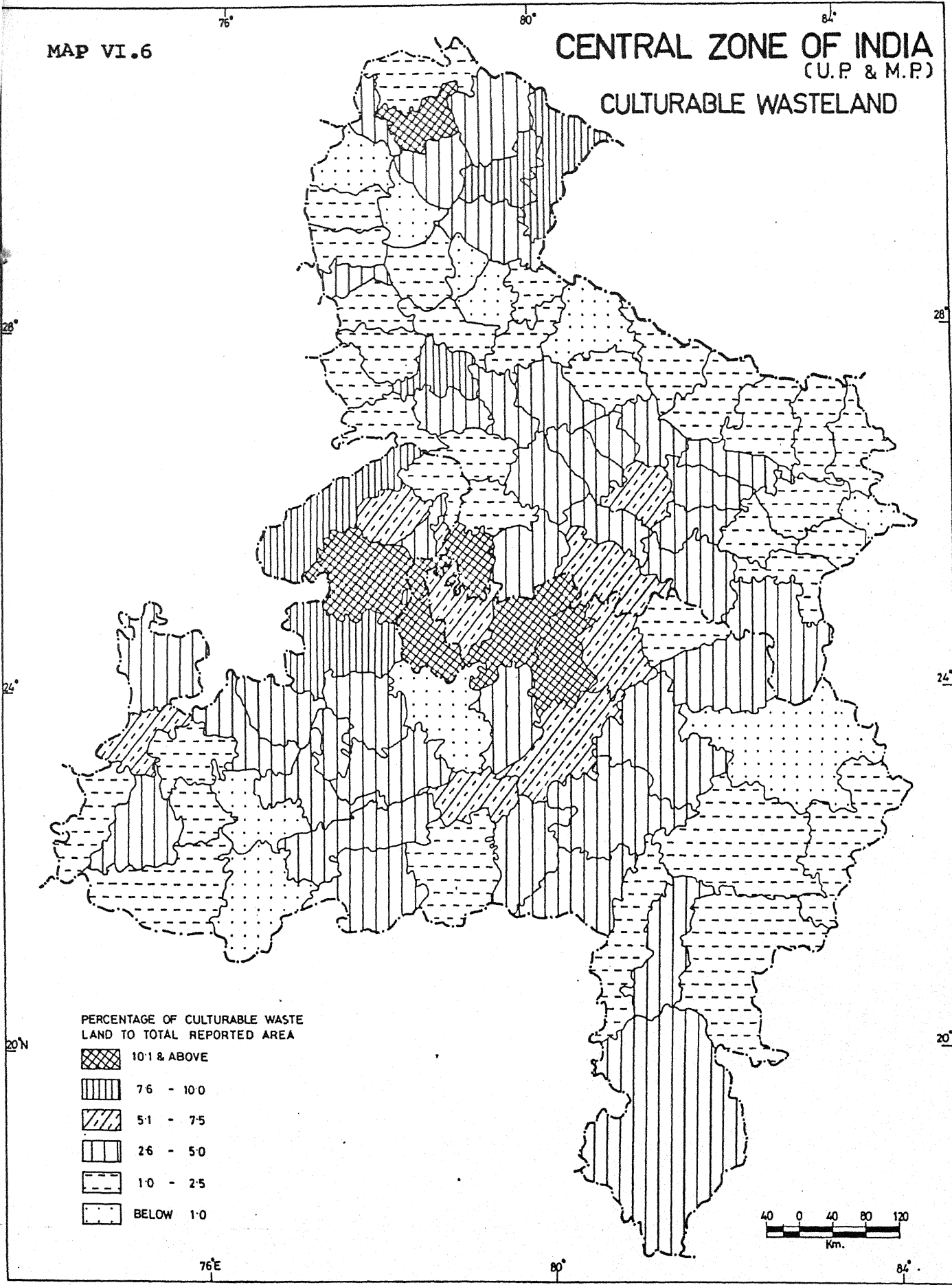
LAND UNDER MISCELLANEOUS TREE CROPS AND GROVES



SOURCE: AVERAGE FOR 1983-84, 84-85 & 85-86
BASED UPON AGRICULTURAL STATISTICS OF U.P. & M.P.

MAP VI.6

CENTRAL ZONE OF INDIA (U.P. & M.P.) CULTURABLE WASTELAND

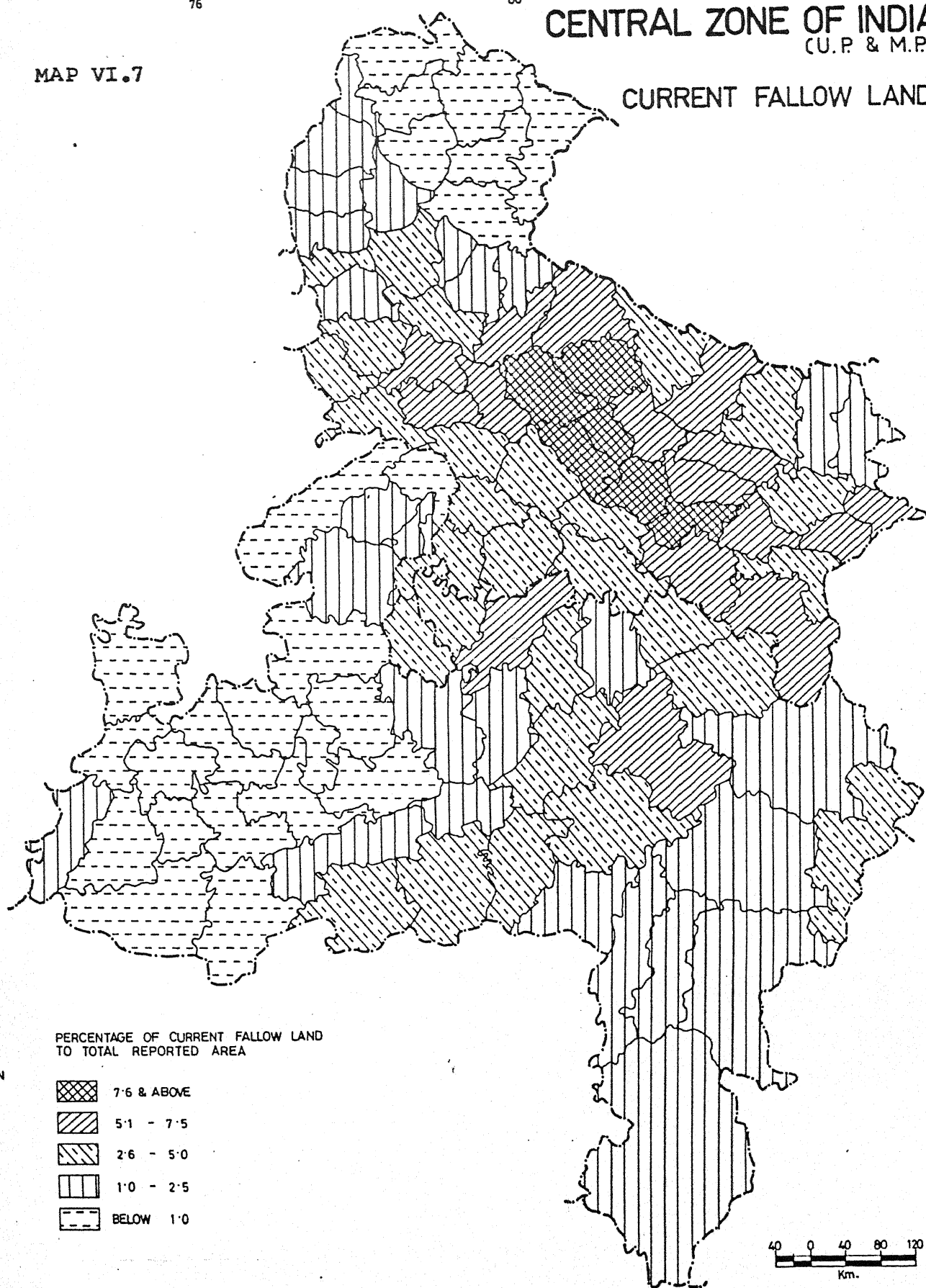


SOURCE: AVERAGE FOR 1983-84, 84-85 & 85-86
BASED UPON AGRICULTURAL STATISTICS OF U.P. & M.P.

MAP VI.7

CENTRAL ZONE OF INDIA (U.P. & M.P.)

CURRENT FALLOW LAND



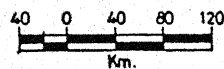
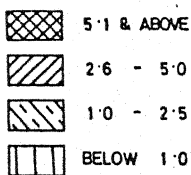
SOURCE: AVERAGE FOR 1983-84, 84-85 & 85-86
BASED UPON AGRICULTURAL STATISTICS OF U.P. & M.P.

MAP VI.8

CENTRAL ZONE OF INDIA (U.P. & M.P.)

OTHER FALLOW LAND

PERCENTAGE OF OTHER FALLOW
LAND TO TOTAL REPORTED AREA

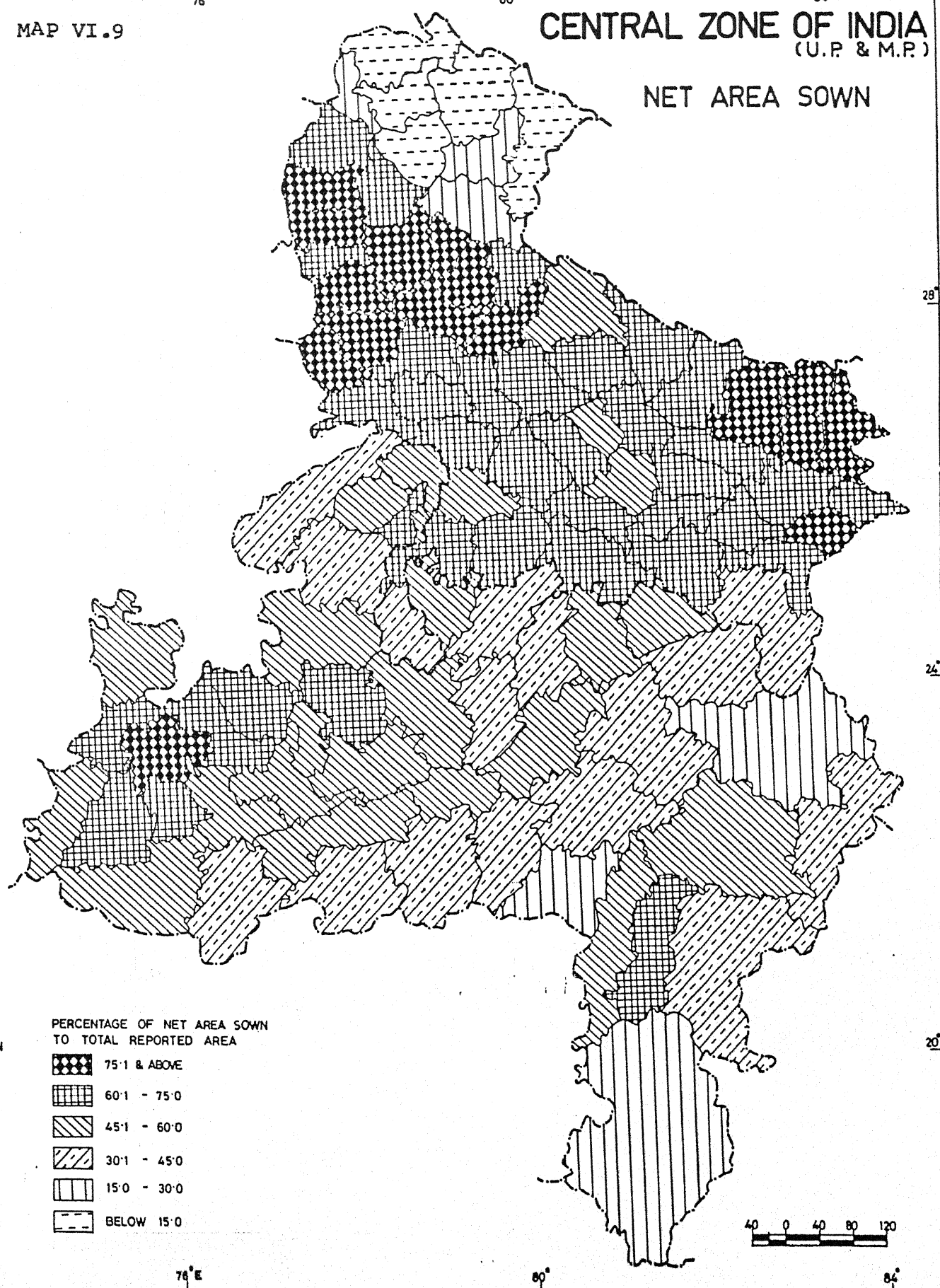


SOURCE: AVERAGE FOR 1983-84, 84-85 & 85-86
BASED UPON AGRICULTURAL STATISTICS OF U.P. & M.P.

MAP VI.9

CENTRAL ZONE OF INDIA (U.P. & M.P.)

NET AREA SOWN

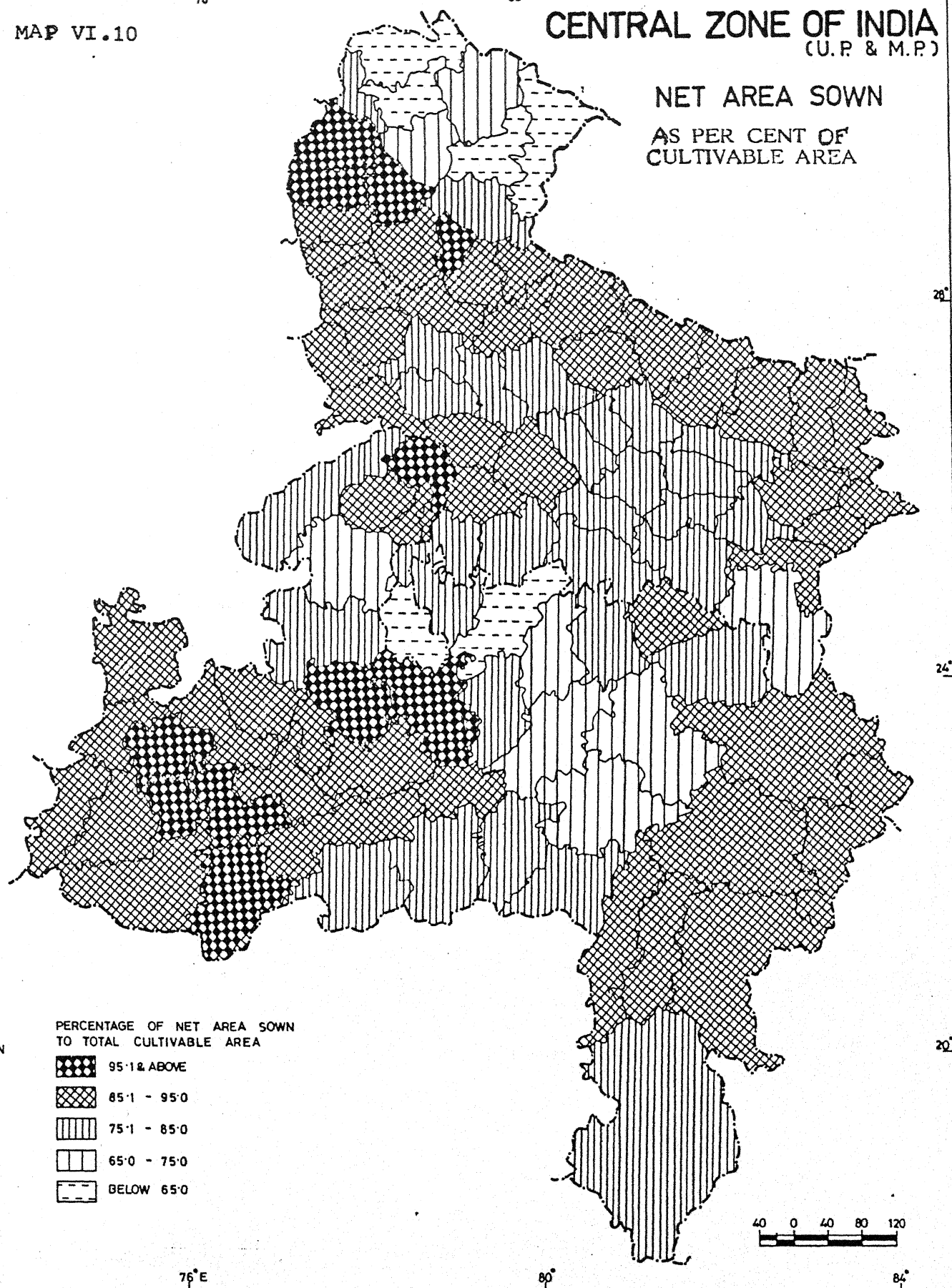


SOURCE: AVERAGE FOR 1983-84, 84-85 & 85-86
BASED UPON AGRICULTURAL STATISTICS OF U.P. & M.P.

MAP VI.10

CENTRAL ZONE OF INDIA (U.P. & M.P.)

NET AREA SOWN
AS PER CENT OF
CULTIVABLE AREA

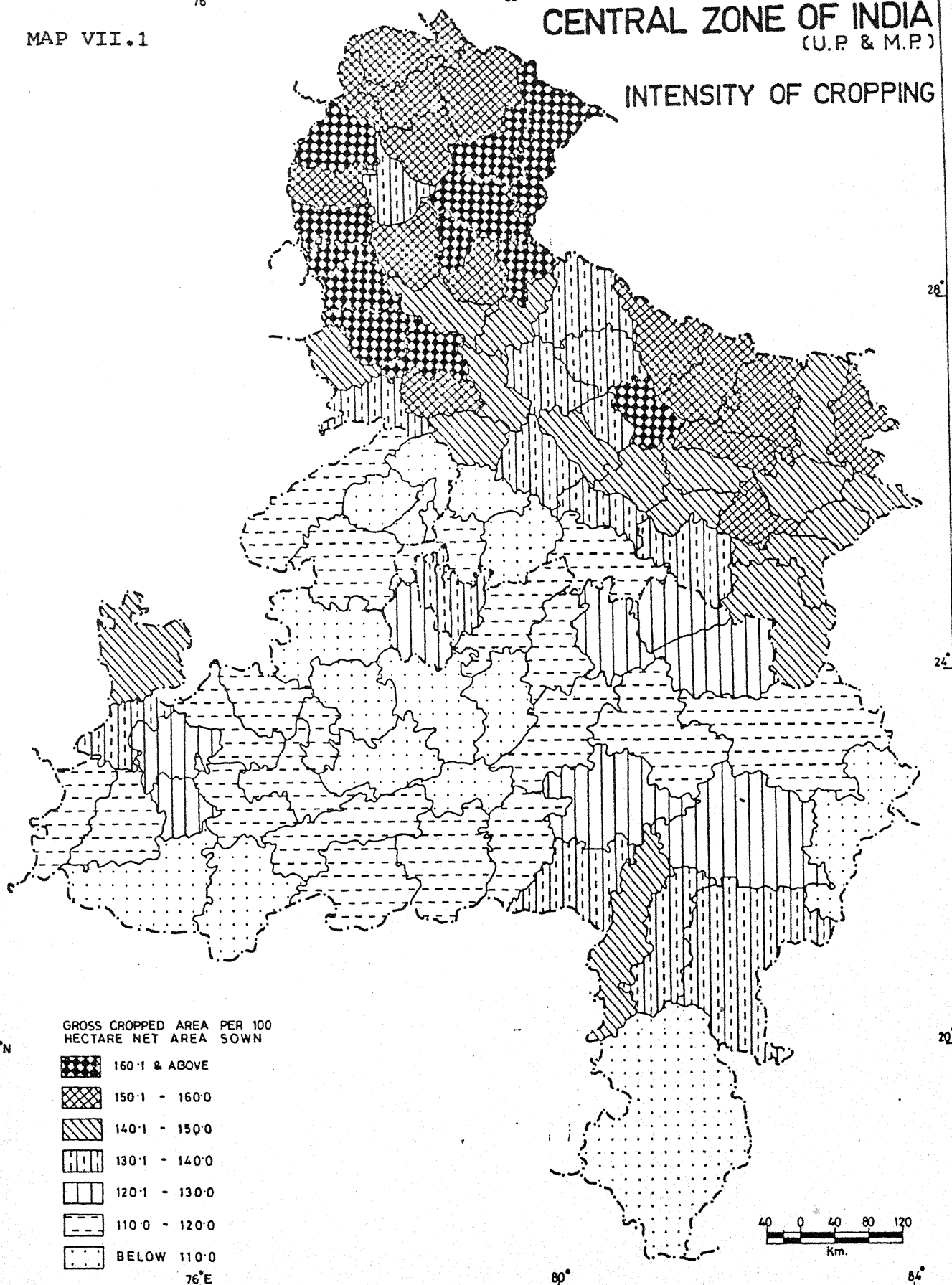


SOURCE: AVERAGE FOR 1983-84, 84-85 & 85-86
BASED UPON AGRICULTURAL STATISTICS OF U.P. & M.P.

MAP VII.1

CENTRAL ZONE OF INDIA (U.P. & M.P.)

INTENSITY OF CROPPING

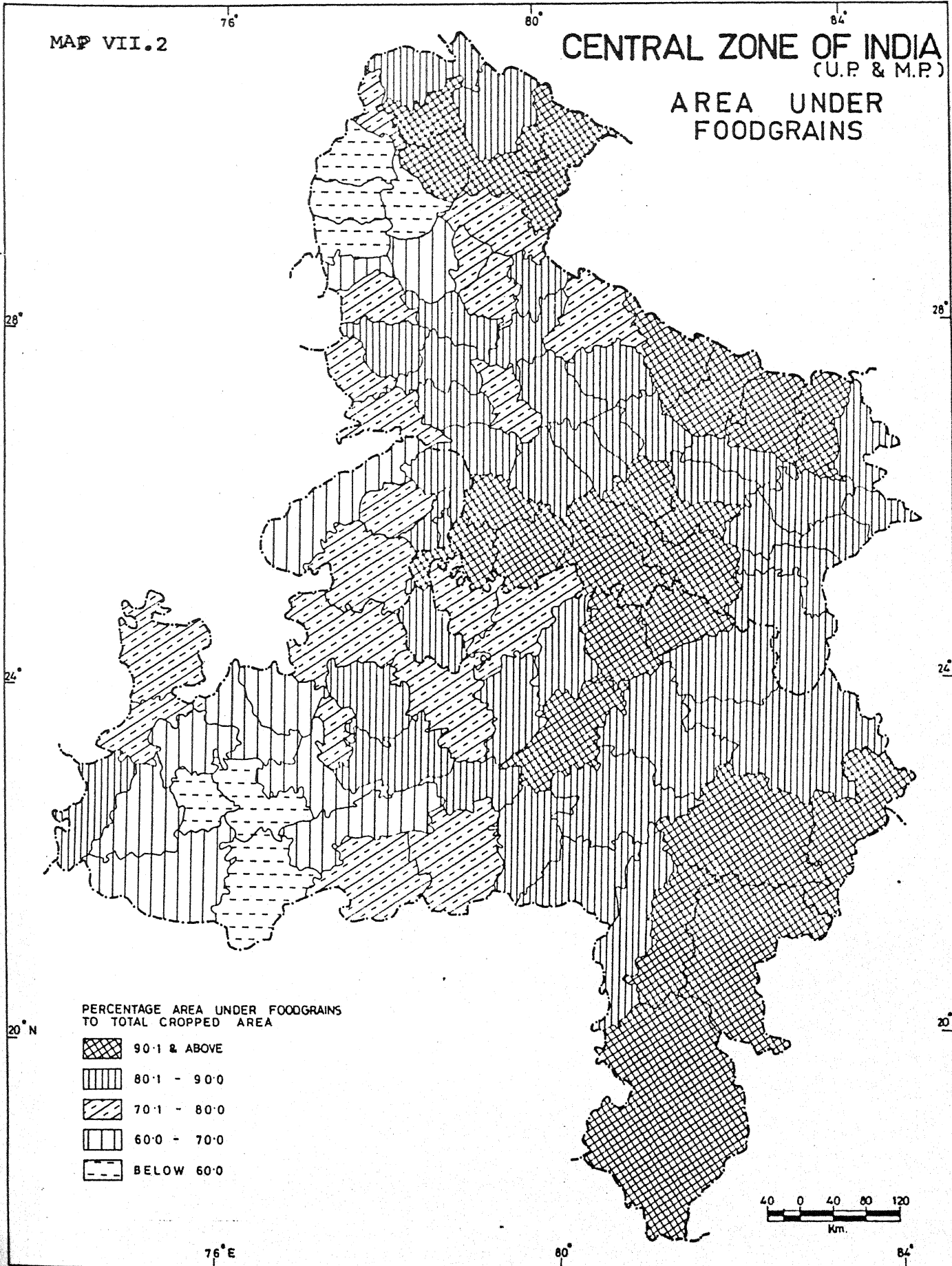


SOURCE: AVERAGE FOR 1983-84, 84-85 & 85-86
BASED UPON AGRICULTURAL STATISTICS OF U.P. & M.P.

MAP VII.2

CENTRAL ZONE OF INDIA (U.P. & M.P.)

AREA UNDER FOODGRAINS

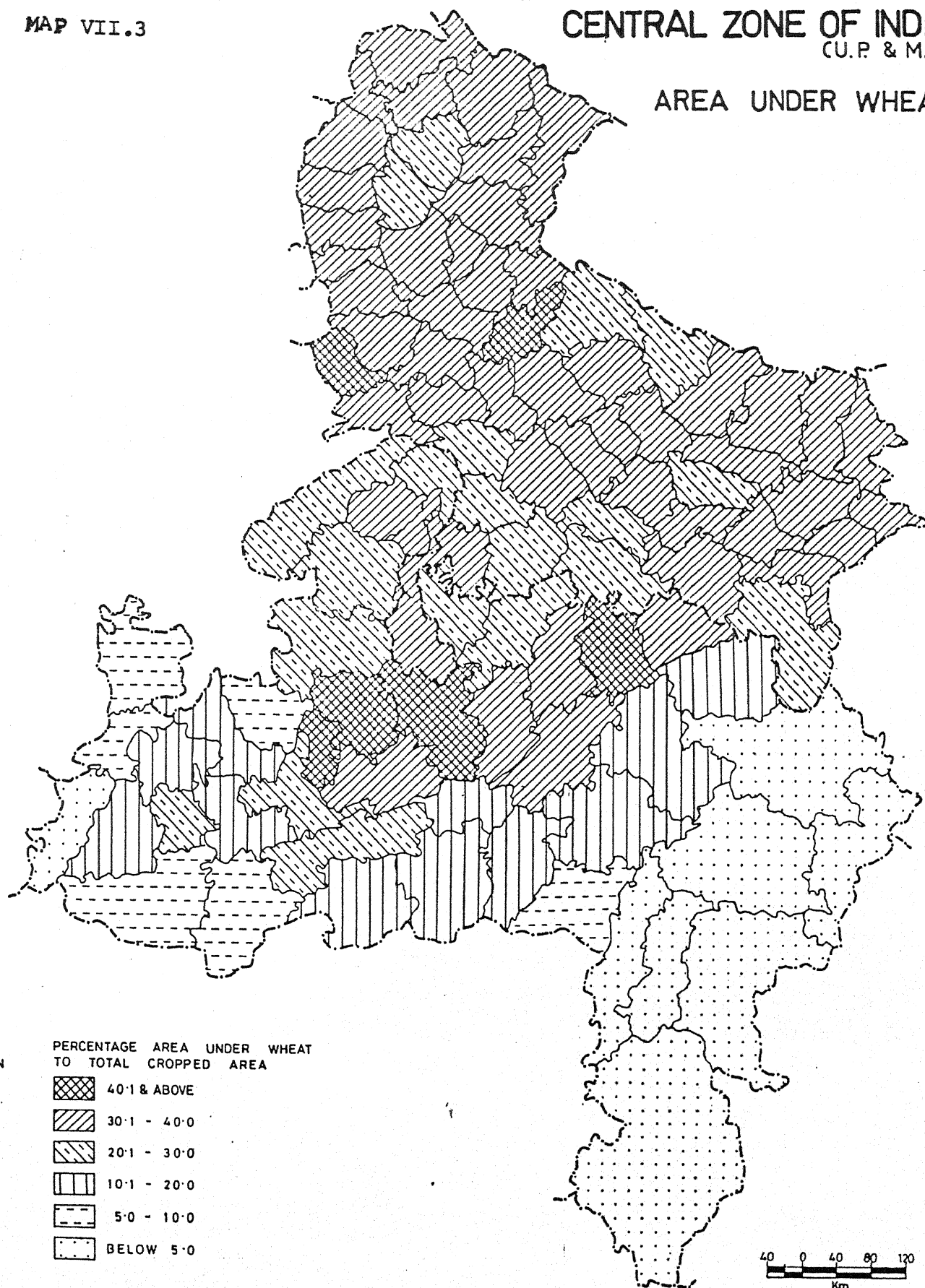


SOURCE: AVERAGE FOR 1983-84, 84-85 & 85-86
BASED UPON AGRICULTURAL STATISTICS OF U.P. & M.P.

MAP VII.3

CENTRAL ZONE OF INDIA (U.P. & M.P.)

AREA UNDER WHEAT



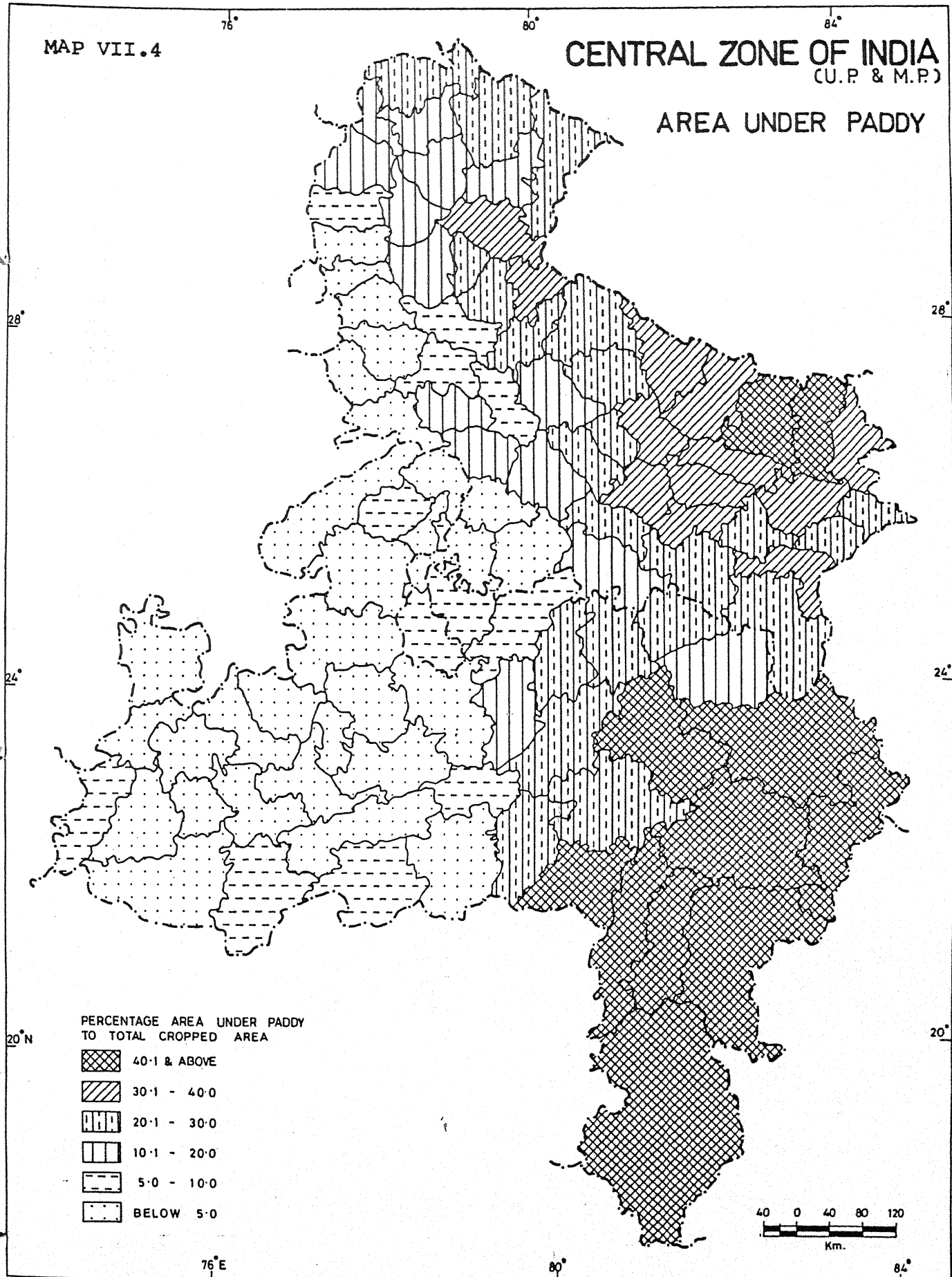
SOURCE: AVERAGE FOR 1983-84, 84-85 & 85-86
BASED UPON AGRICULTURAL STATISTICS OF U.P. & M.P.

MAP VII.4

CENTRAL ZONE OF INDIA

(U.P. & M.P.)

AREA UNDER PADDY



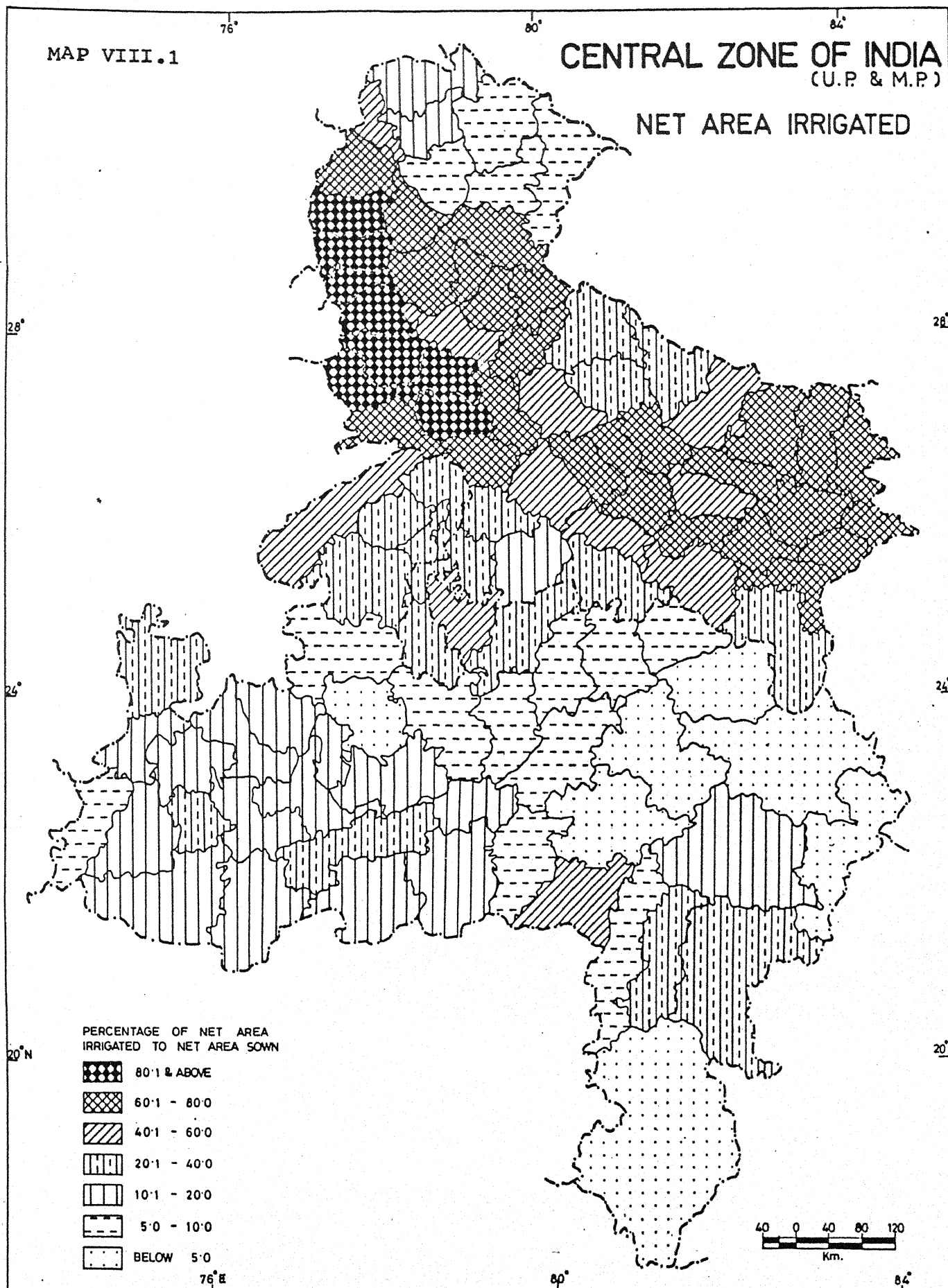
SOURCE: AVERAGE FOR 1983-84, 84-85 & 85-86
BASED UPON AGRICULTURAL STATISTICS OF U.P. & M.P.

MAP VIII.1

CENTRAL ZONE OF INDIA

(U.P. & M.P.)

NET AREA IRRIGATED

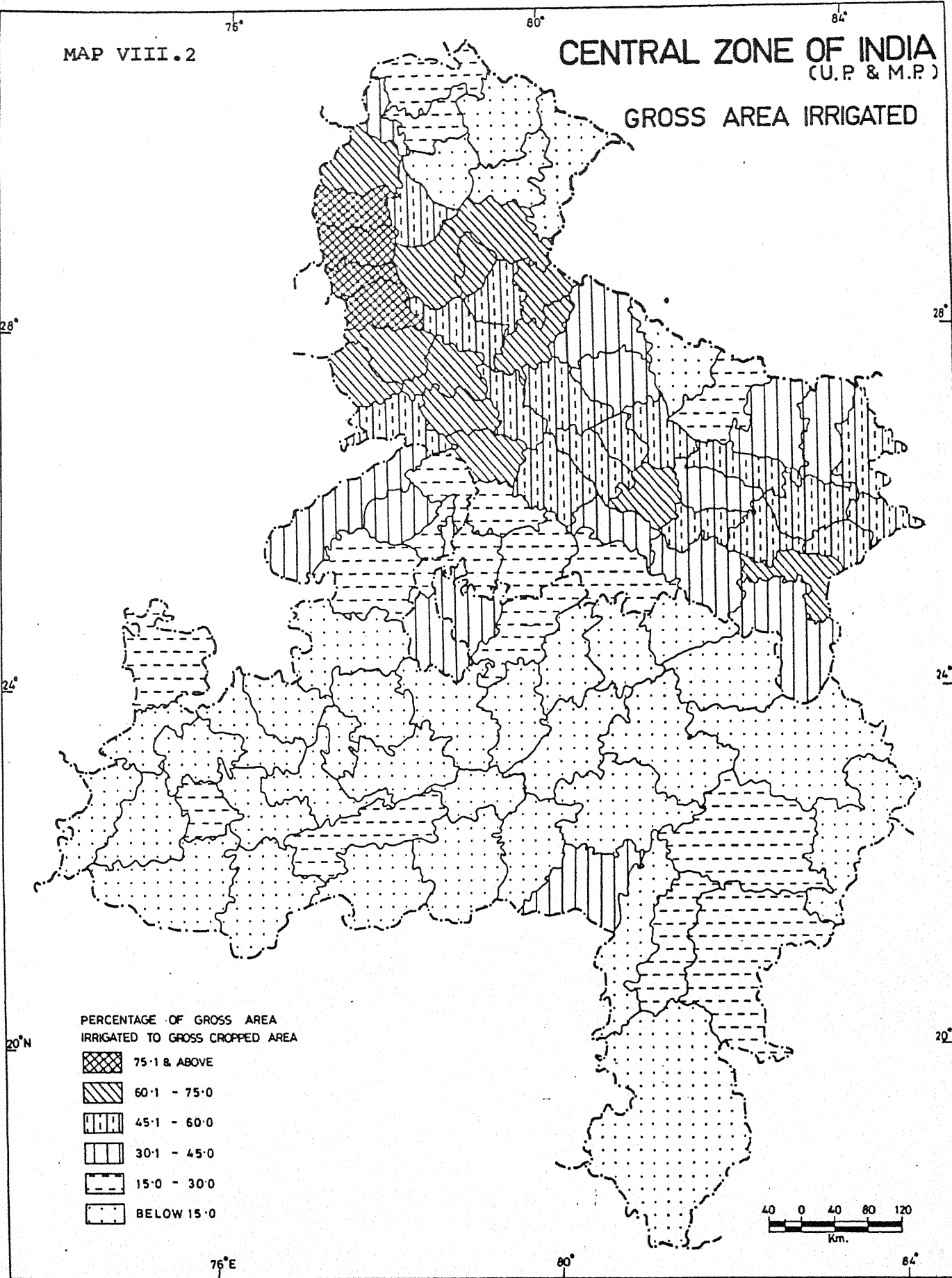


SOURCE: AVERAGE FOR 1983-84, 84-85 & 85-86
BASED UPON AGRICULTURAL STATISTICS OF U.P. & M.P.

MAP VIII.2

CENTRAL ZONE OF INDIA (U.P. & M.P.)

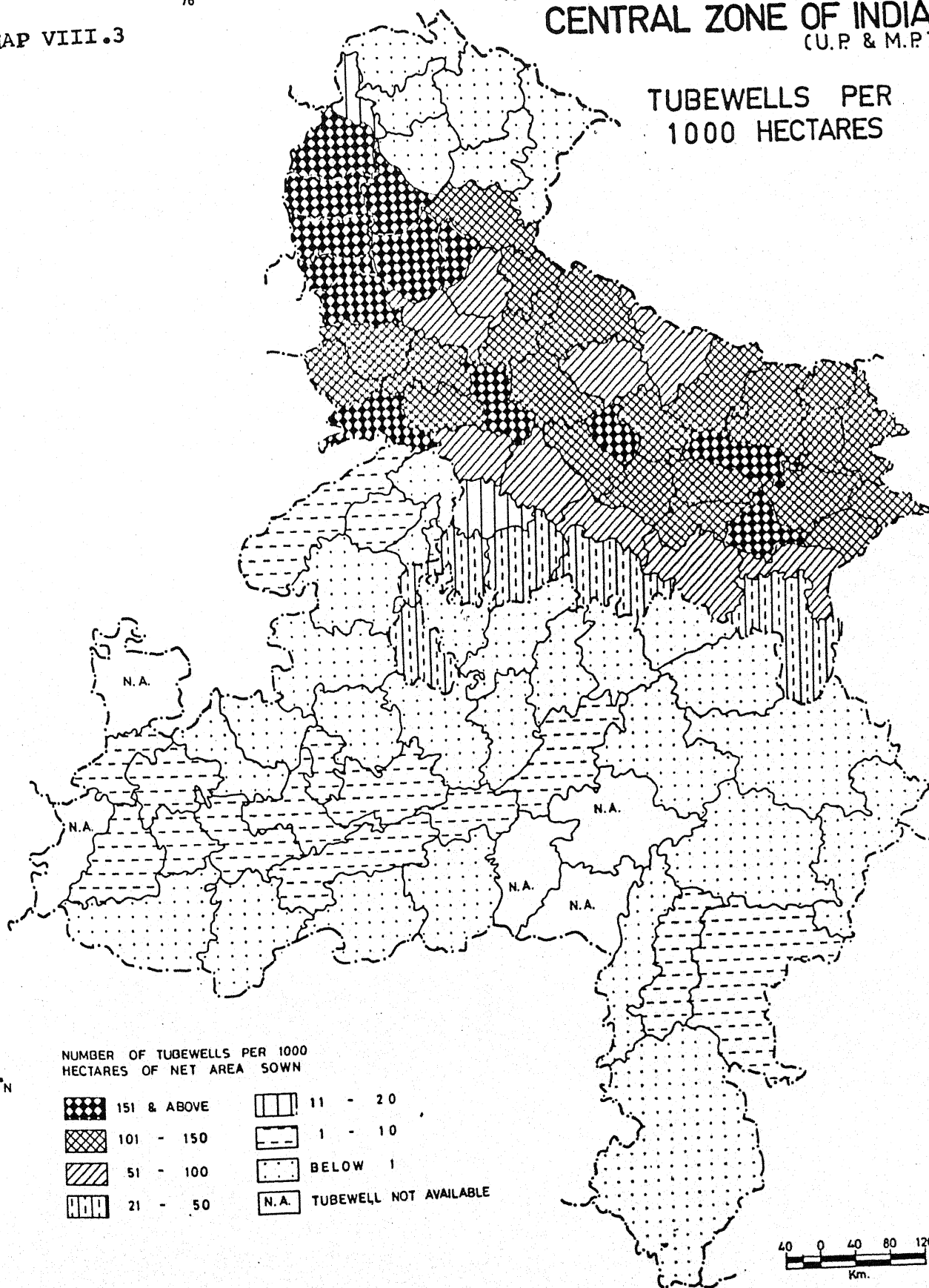
GROSS AREA IRRIGATED



SOURCE: AVERAGE FOR 1983-84, 84-85 & 85-86
BASED UPON AGRICULTURAL STATISTICS OF U.P. & M.P.

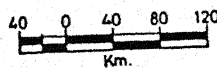
CENTRAL ZONE OF INDIA (U.P. & M.P.)

TUBEWELLS PER
1000 HECTARES



NUMBER OF TUBEWELLS PER 1000
HECTARES OF NET AREA SOWN

	151 & ABOVE		11 - 20
	101 - 150		1 - 10
	51 - 100		BELOW 1
	21 - 50		N.A. TUBEWELL NOT AVAILABLE

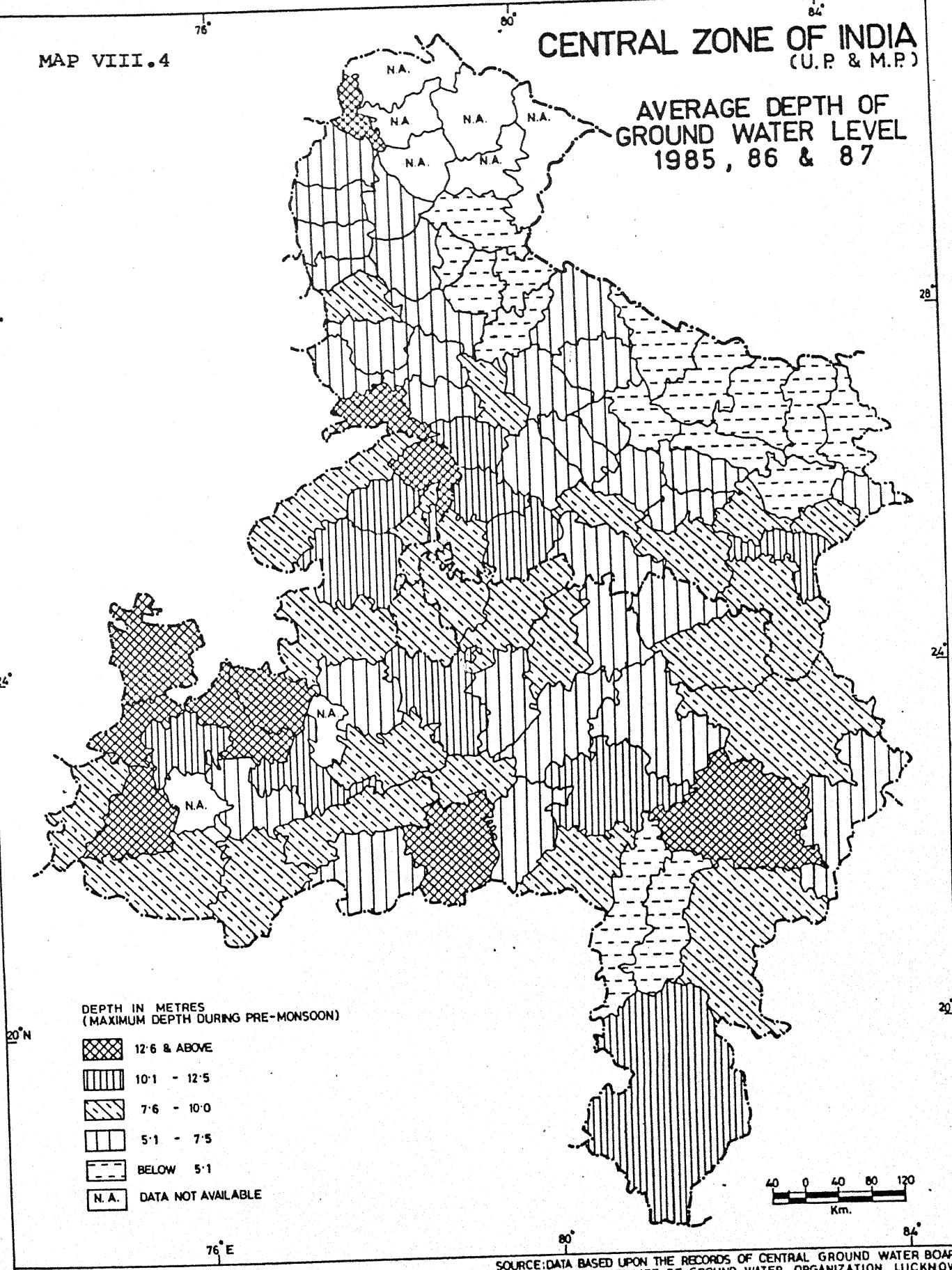


SOURCE: BASED UPON AGRICULTURAL
STATISTICS OF U.P. & M.P., 1984-85

MAP VIII.4

CENTRAL ZONE OF INDIA (U.P. & M.P.)

AVERAGE DEPTH OF
GROUND WATER LEVEL
1985, 86 & 87

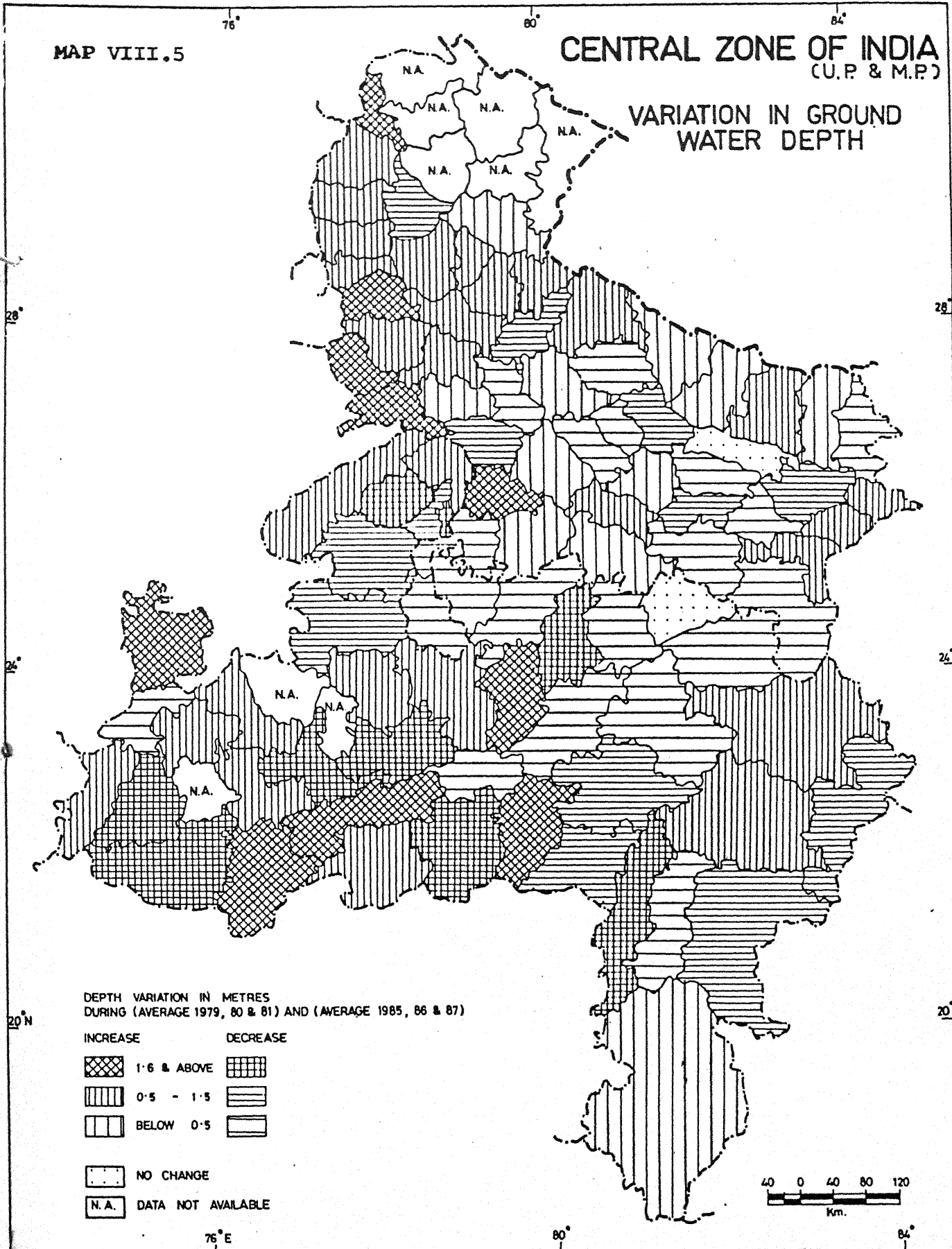


SOURCE: DATA BASED UPON THE RECORDS OF CENTRAL GROUND WATER BOARD, BHOPAL AND DIRECTORATE OF GROUND WATER ORGANIZATION, LUCKNOW

MAP VIII.5

CENTRAL ZONE OF INDIA (U.P. & M.P.)

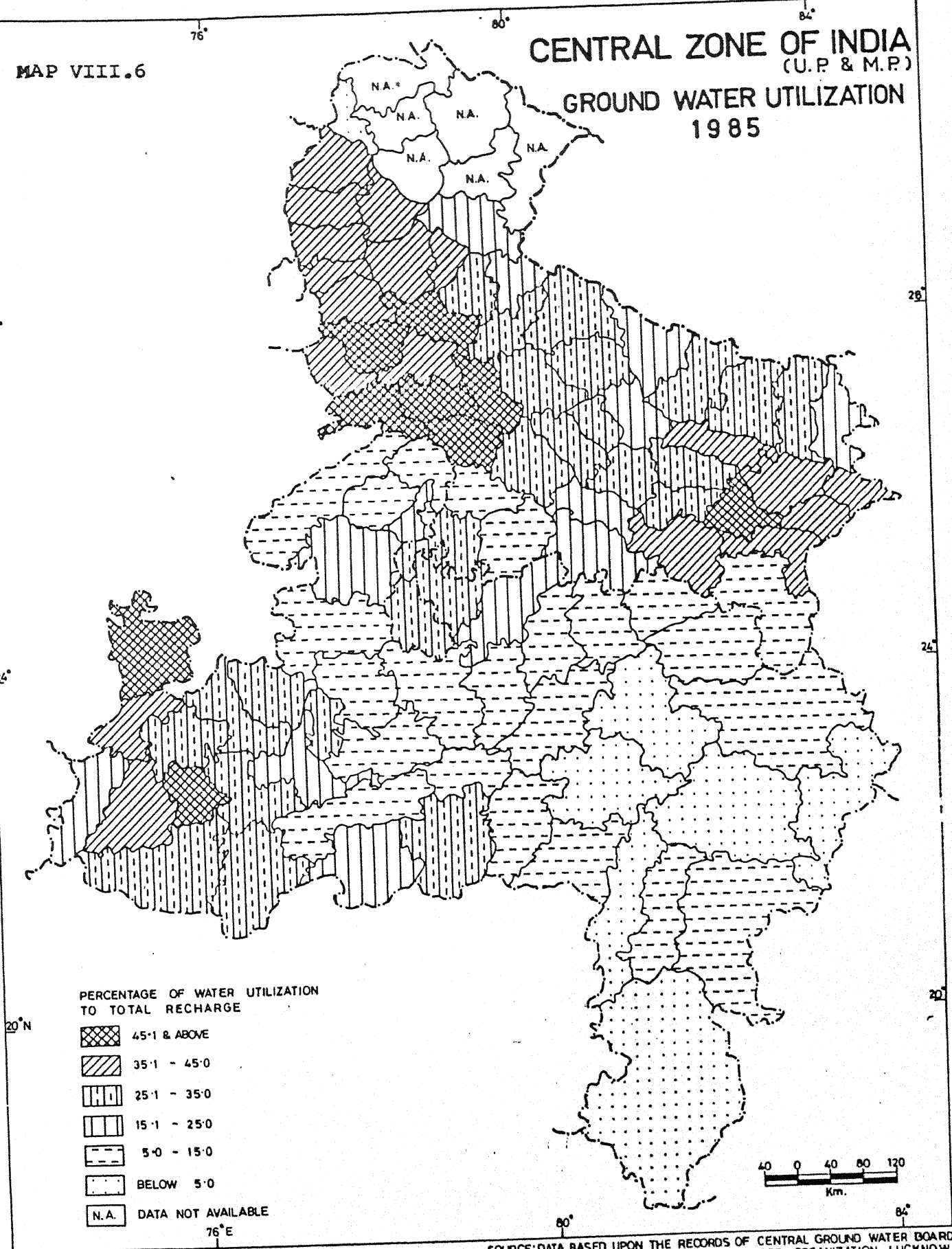
VARIATION IN GROUND WATER DEPTH



SOURCE: DATA BASED UPON THE RECORDS OF CENTRAL GROUND WATER BOARD, BHOPAL AND DIRECTORATE OF GROUND WATER ORGANISATION, LUCKNOW

MAP VIII.6

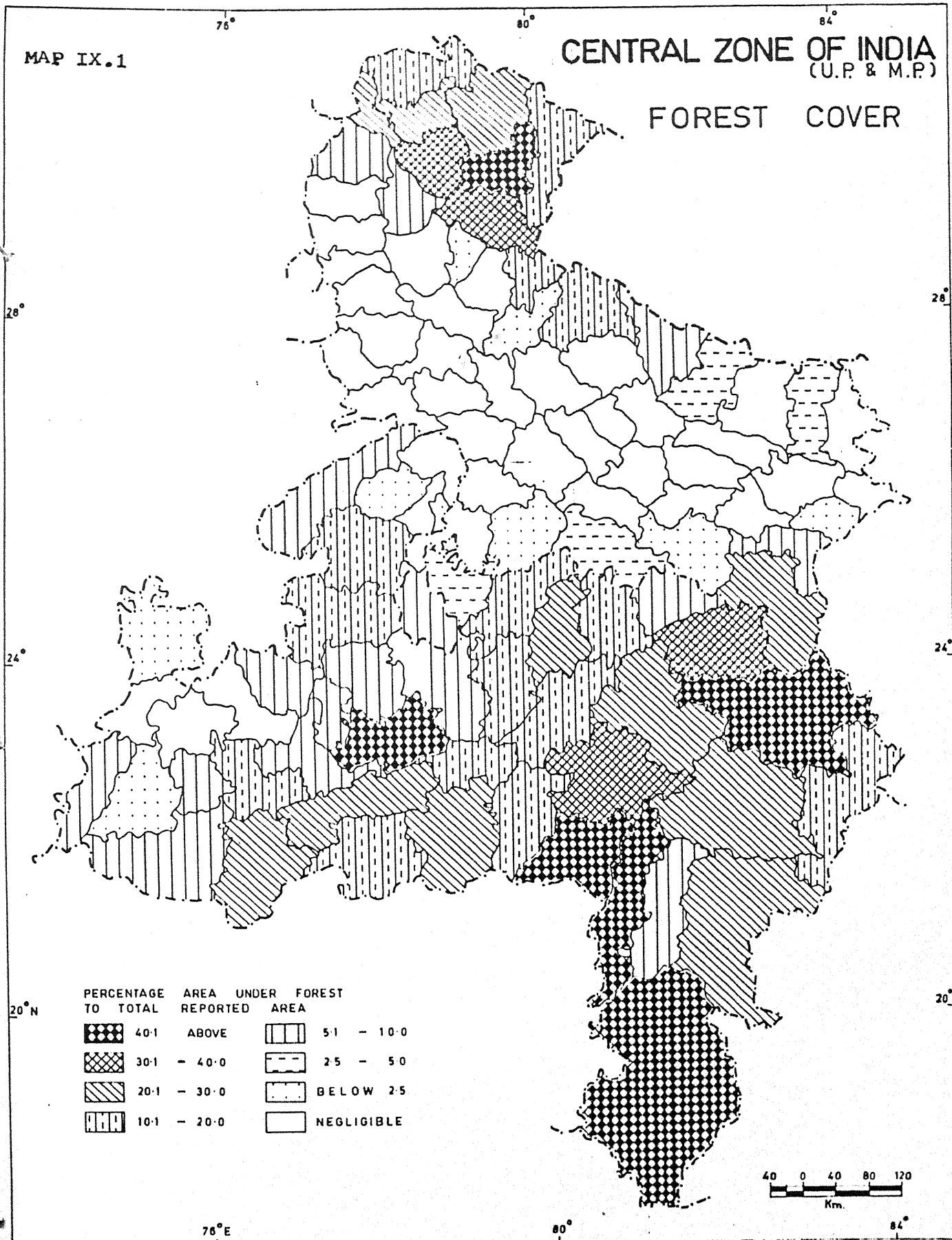
CENTRAL ZONE OF INDIA (U.P. & M.P.) GROUND WATER UTILIZATION 1985



MAP IX.1

CENTRAL ZONE OF INDIA (U.P. & M.P.)

FOREST COVER



SOURCE: FOREST DATA CALCULATED FROM N.R.S.A. MAP OF U.P. & M.P., 1980-82

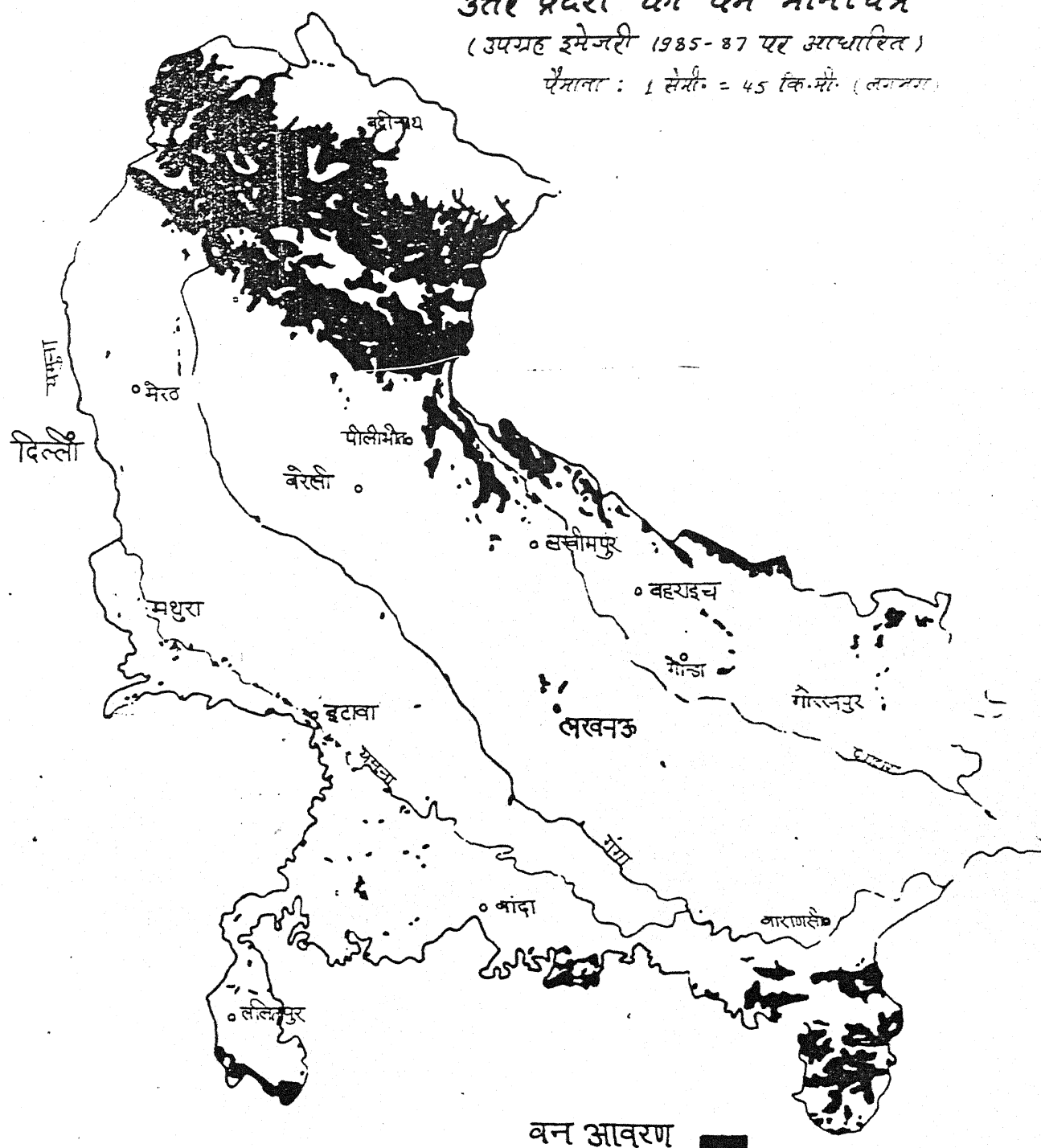
MAP IX.2

FOREST MAP OF U.P.

उत्तर प्रदेश का वन मानचित्र

(उपग्रह इमेजरी 1985-87 पर आधारित)

पैमाना : 1 सेमी. = 45 कि.मी. (लगभग)



MAP IX.3

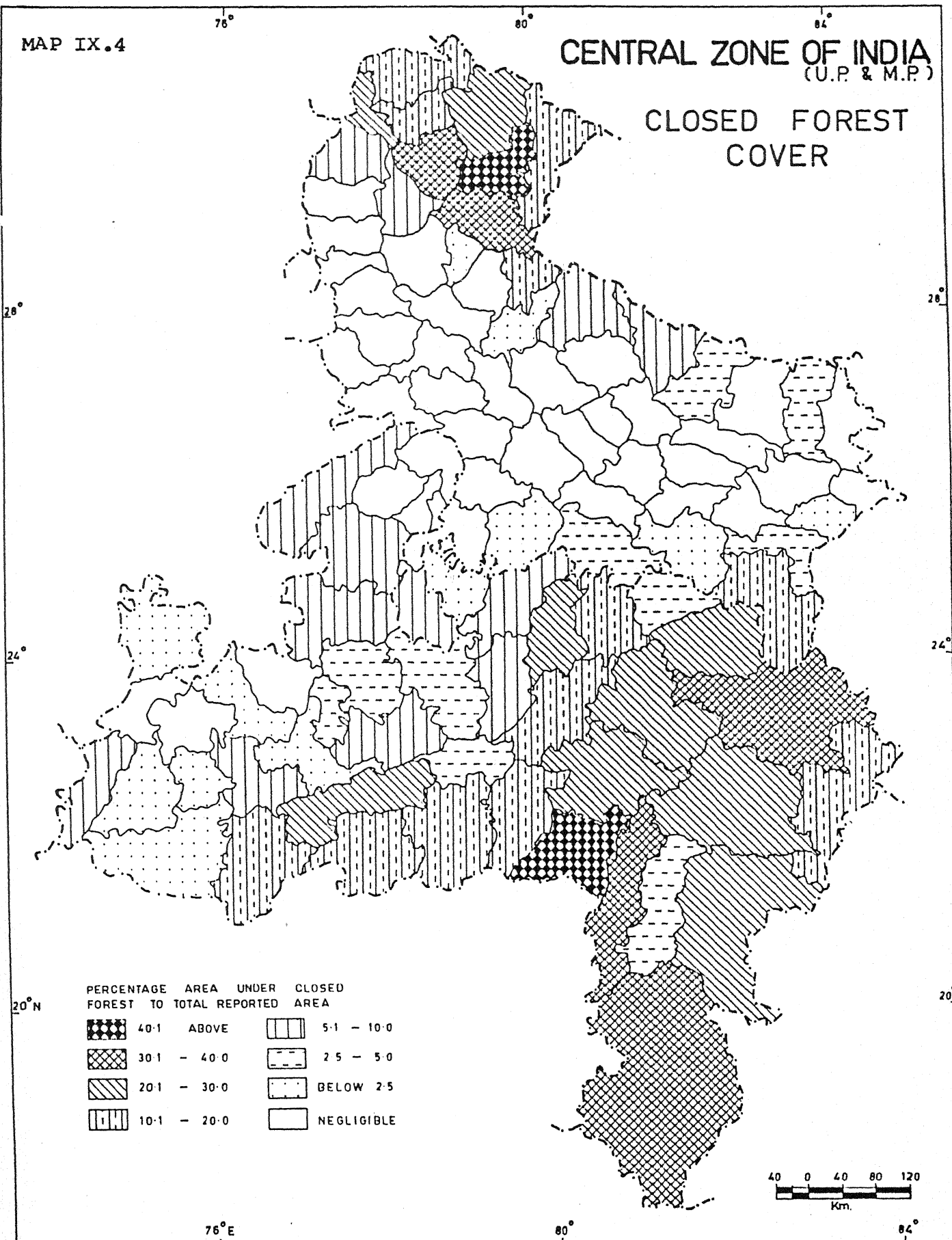
FOREST MAP OF M.P.
मध्य प्रदेश का वन मानचित्र
(उपग्रह इमेजरी 1985-87 पर आधारित)



MAP IX.4

CENTRAL ZONE OF INDIA (U.P. & M.P.)

CLOSED FOREST COVER



SOURCE: FOREST DATA CALCULATED FROM N.R.S.A. MAP OF U.P. & M.P., 1980-82

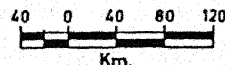
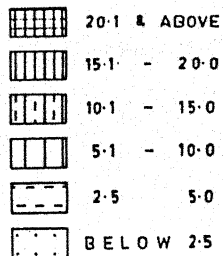
MAP X.1

CENTRAL ZONE OF INDIA (U.P. & M.P.)

CULTURABLE WASTELAND

20°N

PERCENTAGE AREA UNDER CULTURABLE
WASTELAND TO TOTAL REPORTED AREA

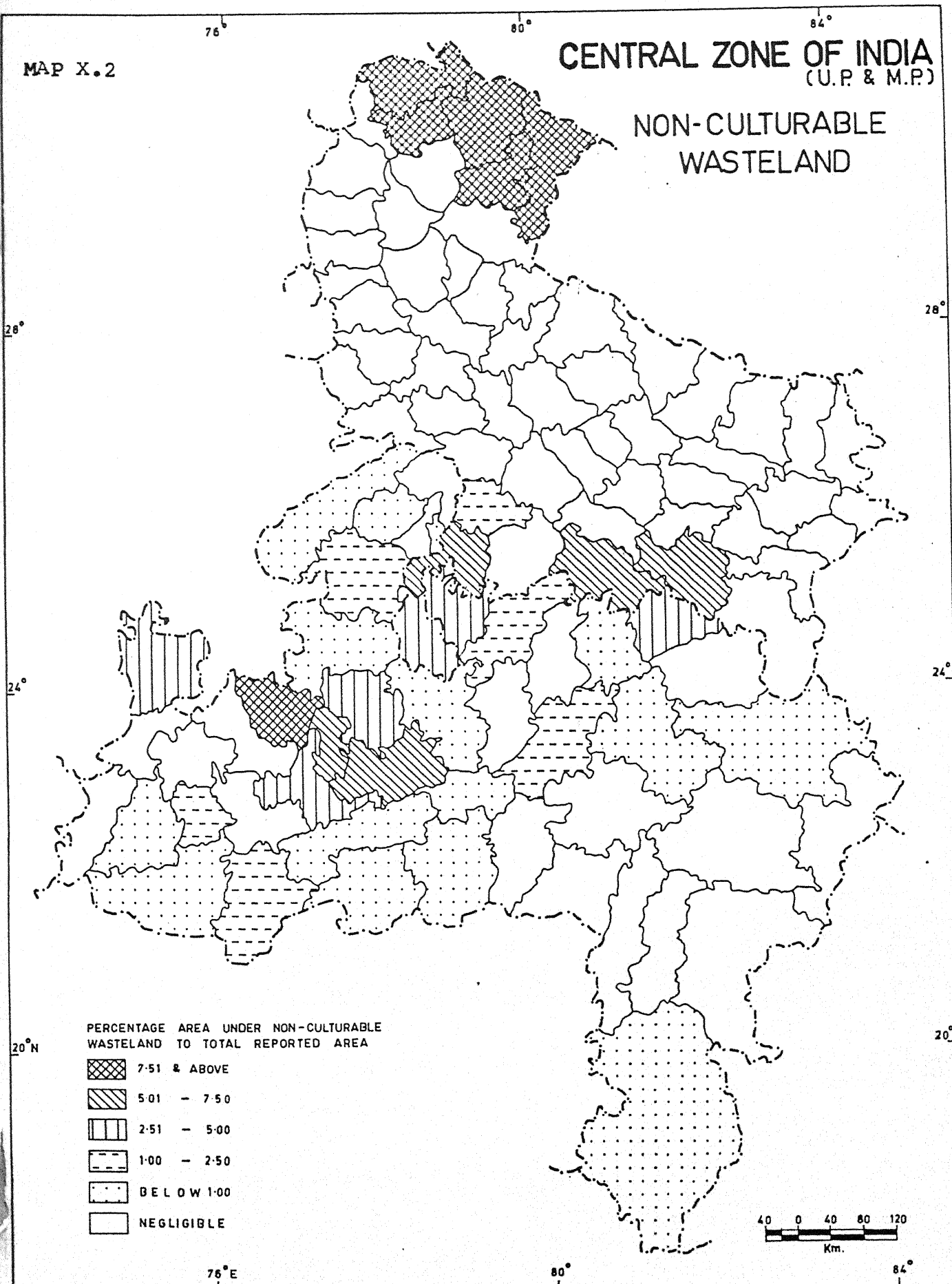


SOURCE: WASTELAND DATA CALCULATED
FROM N.R.S.A. MAP OF U.P. & M.P. 1980-82

MAP X.2

CENTRAL ZONE OF INDIA (U.P. & M.P.)

NON-CULTURABLE WASTELAND



SOURCE: WASTELAND DATA CALCULATED
FROM N.R.S.A. MAP OF U.P. & M.P. 1980-82